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CONTENTS

| | Page |
|--|------|
| Issues Concerning Measurement of the Population at Risk in Crashes, by Julian A. Waller | A 1 |
| Abstract Citations | 1 |

ISSUES CONCERNING MEASUREMENT OF THE POPULATION AT RISK IN CRASHES*

by

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There is a small poem that says:

Oh, let us never never doubt

What nobody is sure about.¹

Although this poem is an appropriate description of all aspects of data definition, gathering, interpretation, and analysis for highway safety, it is most appropriate to the issue of exposure. If they think of the issue at all, most safety practitioners are certain that it is not very important and can be largely ignored. A smaller group is equally certain that such data are needed, but they are reasonably comfortable with the estimation of exposure by means of calculations based on gasoline sales. Fewer yet are positive that the issue is important, in fact essential, to understanding most highway phenomena, and they are equally certain that most methods of estimation currently in use are exceedingly primitive and largely inaccurate. I count myself among this latter few, and my goal in this discussion is to document where and why information about exposure is important, what some of the current problems are in arriving at estimates, and what, if anything can be done about these problems.

In this discussion, I will use three terms interchangeably. These are exposure, denominator, and population at risk. In statistics, rates are made up of two components: a numerator, or information about the number of crashes or injuries that have occurred, and a denominator that describes the population at risk of crash involvement or injury. In many cases, the denominator can simply be the number of people or cars that are using the roads. But, this denomi-

nator often is inadequate, and information is needed more specifically about the amount or type of use. Therefore, we talk about exposure. A number of tricky and in some cases sophisticated considerations are involved in defining the denominator, whether it be people or use, and I will pay attention broadly to these problems rather than limiting myself only to the question of use alone.

Information Needs for Safety Programming

Let us start by examining the types of information that are needed for safety programming. First, there is the need for data about the frequency of highway crashes. In order to be useful, this information should not be limited to reports of the total number of such events in a given community or time frame, but should cover as well subgroupings according to age, sex, race, driving experience, type of vehicle, category of roadway, hour, day of week, and other factors that may be pertinent to program planning.

Second, information must be available about the relative severity of events. Again, it is important that such information be subdivided according to the groupings noted above as well as being provided for entire communities. It is quite relevant, for example, not only that a certain number of crashes occur involving motorcycles or the elderly, but that such crashes on the average are more likely than are crashes involving automobiles or younger persons to be severe as measured by the proportions that result in fatalities.

The third type of data needed is causal information. What are the relative contributions of various factors in the causation of crashes of specific types? In

* Presentation at Second National Forum on Traffic Records

information about the crash data to use in such a way that it leads logically but not necessarily obviously to appropriate countermeasures. The difference between obvious and logical is that an obvious solution is one suggested primarily by examining relative frequencies of different factors in crashes and by attacking first the factors with highest frequency. A logical solution on the other hand is one that may include information about frequency as one of its considerations, but that is suggested primarily by examining relative feasibility of countermeasures for affecting ultimate outcome of death, disability and discomfort and for having limited unwanted side effects such as excessive economic or social costs. Occasionally, but not often, an obvious solution is also a logical one.

The last necessity for program planning is information about the effectiveness of countermeasures. The history of highway safety, and other safety programs as well, unfortunately, is a story of repetitive initiation or continuance of activities that sound exciting to someone in theory, or that are attractive to the news media, but usually that have never been evaluated, have been evaluated in unscientific fashion, or have been tried and found not to be effective. If our ultimate goal is to reduce property loss, carnage and misery we must know what works in the most effective and least costly manner.

My discussion of data will undoubtedly sound extremely pessimistic because serious problems exist both in defining frequency, severity, and causation of those crashes that occur and in collecting such information even within such definitions as exist. These issues of inadequacies of information about the numerator have been considered elsewhere², and my purpose here is only to examine exposure or denominator information.

Why Exposure Data Are Needed

In my opinion, unless there are good measures of exposure, it is impossible to accurately determine relative frequency, causation or countermeasure effectiveness even if numerator information is excellent. Some examples will provide clarification.

The following are a few statements commonly heard about various aspects of highway safety:

1. The death rate per 100 million vehicle miles has been decreasing steadily.
2. Women have fewer crashes than men.

3. Elderly drivers are just as safe as younger drivers and therefore require no special attention from licensing agencies.

4. Trucks have better safety records than do automobiles, and therefore an increase in maximum truck size should pose no hazard.

5. High-rise bikes are more hazardous than regular bicycles and should be banned.

6. Several thousand persons a year are killed in crashes in which a vehicle catches fire, and therefore standards to improve the integrity of fuel tanks should be established to prevent such fires.

7. Drivers with violations have more crashes than do drivers with citation-free records.

8. Even one or two drinks makes a person an unsafe driver.

9. Median barriers improve safety.

These statements deal with frequency, causation and countermeasure effectiveness. Each of these statements can be found either to be true or untrue depending on whether exposure data are used and what types of populations at risk are chosen. I wish to consider each of them individually because they can illuminate some of the unique issues involving exposure and population at risk.

"The death rate per 100 million vehicle miles has been decreasing steadily over a number of years. This statement is correct as far as it goes and the decline is usually attributed to improvements for safety. But airplane and rail statistics are measured in passenger miles rather than vehicle miles. It is suspected that at least some of the drop in automobile fatality rates is that through the years the number of occupants per vehicle has been decreasing. Therefore, passenger miles would be a more relevant denominator for automobile traffic as well.

"Women have fewer crashes than men." The basis for this statement is the common observation from state licensing and crash statistics that, while comprising about 45% of licensed drivers, women have only a little over a quarter of the reported crashes. In 1974, for example, women were 44% off the 125 million licenses but 29% of the 25 million drivers in reported crashes.³

If the denominator used is the number of licensed drivers the crash rate per 100 licensed drivers is 25.1 for men but only 13.1 for women. On a mileage basis, according to the National Safety Council data

the crash record for women per ten million miles is about 20-25% better than that of men.³

As the Safety Council points out, however, there is reason to believe that women drive less hazardous roads, types of vehicles and times of day than do men. One study has examined the crash rates of both sexes in which each driver in a crash was matched with another driver not in a crash but who was using the same roadway segment during a similar day, hour, and season.⁴ In this study, where type of exposure has been taken into consideration, the "accident vulnerability ratios" for women actually were slightly higher than those of men in almost all age categories and for all blood alcohol concentrations, largely because men are more likely to have high blood alcohol concentrations than are women; however, men have substantially greater involvement in fatal crashes than do women.

"Elderly drivers are just as safe as younger drivers and therefore require no special attention from licensing agencies." Per hundred drivers the elderly have no higher crash rate than do middle-aged persons and thus no cause for alarm can be identified.⁵ When corrected, however, for the fact that the average elderly driver travels only about half as many miles per year as do younger persons, it is apparent that the elderly are at greater risk of crashing for each mile that they drive.^{4,6} But personnel of a motor vehicle agency can point out that they license drivers, not miles. However, even per hundred drivers the elderly are substantially more likely to be fatally injured in crashes³, thus warranting attention.

A similar issue involves the crash rates of trucks. Currently the trucking industry is waging an intensive public relations and lobbying program to convince the Congress, state legislators, and the public that there would be little risk to safety if the maximum permissible load for trucks were increased. It is relevant that even now the size and weight of trucks is such that the automobile and motorcycle driver already is sharing the road with the inertial equivalent of a 4,000-lb. vehicle travelling at 250 miles per hour.

What are the facts? Overall, as of 1972, trucks of all sizes from pickup to double bottom were 17% of licensed vehicles and 12% of all vehicles involved in crashes. Tractor-trailer trucks comprise less than 1% of licensed vehicles but 2.6% of total crashes and 7.3% of fatal ones.³ However, as the truckers promptly and correctly point out, their vehicles tra-

verse many more miles per year than do virtually all other vehicles except taxis. Therefore, on a per-mileage basis trucks have no greater than average crash rates, especially if one includes the 96% of trucks that are smaller than the tractor-trailers, a common statistical procedure of the American Trucking Associations.

But look again. By far the greatest amount of mileage for trucks is on interstate roads and other freeways; roads that for all vehicles average only one-half to one-third the crash rate of other parts of the highway system. When trucks on freeways are compared mile-for-mile with other vehicles on freeways, they do poorly indeed.⁶ In other words, one must look not only at the crash rate per unit mile but must examine the type of exposure as well. When that is done it becomes clear that the trucking industry is playing with figures, and with our lives.

"High-rise bikes are more hazardous than regular bikes." Again the issue is not just one of examining the amount of exposure but the type of exposure as well. In one study,⁷ the injury rate over a four month period for standard bikes was 9.3 per 1000 users, whereas for high-rise bikes it was 14.8. Both groups had similar amounts of exposure. However, 45% of boys but only 22% of girls owned high-rise bikes and it is most relevant that at practically all ages and for most activities males have higher injury rates than do females. In this case, the exposure of males on high-rise bikes had to be compared with that of males on standard bikes, and the same for females. When this was done, the difference between the two types of bicycles disappeared.

"Several thousand persons a year are killed in crashes in which a vehicle catches fire and therefore standards for fuel-tank integrity should be established." This particular question involves identification of a very special denominator. At first glance it might seem that the population at risk is all persons whose vehicles are involved in fires after crashes. But if the concern is with saving lives and limbs the proper population at risk is only those persons who have crashed but who haven't already been killed or fatally injured in the seconds or milliseconds before the fire begins. That population is extremely hard to identify, and cannot be identified at all in the absence of complete and competent autopsies for all persons who die as a result of crashes involving fires.

"Drivers with violations have more crashes than do drivers with citation-free records." There is a hidden assumption about exposure in this statement. The assumption is that the more recklessly a person drives and the more often he or she does so, the greater the likelihood of getting into trouble as manifested both by receiving traffic citations and by crashing. Thus, as used in the above statement, traffic citations represent a surrogate measure for violation-loaded exposure.

So many problems exist in defining, measuring, and interpreting this issue that I hardly know where to begin. First, there are the difficulties in defining unsafe driving. Whereas a traffic citation is a discrete entity, the behavior it purports to measure frequently is ongoing and amorphous. Failure to obey a traffic light also is a limited or discrete act. But how, for example, does one measure exposure to excessive speed above posted limits if in one case driving for 40 miles at speeds ranging from 10 to 25 miles per hour over the limit results in a ticket and in another case a ticket is given for 3 miles of speeding at 10 mph over the limit? Let us further assume that in one instance such behavior occurs at 2 a.m. when there is virtually no other traffic and at another time takes place at 9 p.m. when traffic is somewhat heavier. How does one even begin to define the exposure in a way that can meaningfully be related to crash risk?

Furthermore, assuming a person is stopped by the police, the "unsafe behavior" may result in no citation at all, a ticket for speeding, one for reckless driving, or for any one of several other possibilities in the motor vehicle code.² I will not discuss at all the voluminous data² documenting that citations are issued and recorded differently according to age, sex, race, political ideology, occupational status, and community, and thus represent a very biased estimate of exposure.

To these problems we must add yet another one. A measure of exposure is useful only if it is an independent variable, that is, if it precedes rather than results from the injury event. This is not the case with citations that are associated with highway crashes. In many cases, a citation is given because a violation is identified as a result of investigation of the crash. Such citations are dependent variables rather than predictors, and in these cases a correlation between crashes and exposure as measured by number of citations has been automatically and spuriously built in. Studies that exclude citations resulting from

crash investigation show a much smaller relationship between traffic citations and crashes.⁸

"Even one or two drinks makes a person an unsafe driver." If this statement, which has been quoted for many years, is correct, the messages we must give the driving public are quite different than if impairment does not occur until larger amounts of alcohol are consumed. I have included it because I suspect that most of you already are familiar with the several excellent studies of crashes involving alcohol that control for driving exposure.⁹⁻¹¹ These studies have all shown that, in general, risk of crashing does not begin to rise until a blood alcohol concentration of 50 mg% (.05% by weight) is reached.

But, as with the examples noted previously, attention must be paid not only to generalities for all population groups combined but also for experiences involving specific groups or circumstances. Thus, although crash risk overall does not rise until the equivalent of 3 to 4 drinks in a hour are consumed, two important exceptions can be noted. These are teenagers¹⁴ and persons driving in heavy traffic, such as at rush hour,¹² who do have an increase in crash risk beginning at very low blood alcohol concentrations.

"Median barriers improve safety." The reason for erecting median barriers is to prevent vehicles from crossing over and crashing into oncoming traffic, a uniquely serious type of event. If the denominator is limited only to cars involved in crashes the beneficial effects are quite spectacular. Using cable barriers as an example, there is a marked reduction in head-on crashes and a 35% reduction in fatalities comparing sites where such barriers have been erected with similar sites or time periods without barriers.¹³

Let us now expand the definition of population at risk to include not only vehicles involved in crashes but all vehicles going by a given spot. What now becomes apparent is that there is a 30% increase in all crashes, a 40% increase in property-damage ones, a 20% increase in injury crashes overall, but a 35% decrease in fatal events.¹³ Similar results are seen for beam-construction barriers which have largely replaced cable barriers and in turn are now being supplanted in some places by "safety shape" concrete ones. In my opinion the saving of life and limb more than outweighs the increase in more minor events. Some drivers in fact purposely crash into the barrier in order to avoid sidswiping another car. The issue

here, however, is that the choice of denominator can substantially alter the interpretation of effectiveness of a given countermeasure.

Methods for Estimating Exposure

Having by now, I hope, effectively documented both the need for adequate denominator data and the effects of different denominators, I would like to examine three specific methods available for estimating exposure. These are the gasoline sales-method, the household interview, and the roadside survey.

The gasoline-sales method has one major advantage. It is quite inexpensive, depending only on analysis of data already likely to be available. It cannot be applied, however, with any hope of accuracy to an area smaller in size than an entire state. In fact, in my opinion, even at the state level the estimates are so crude as to be largely useless.

First, one must determine how much of the gasoline sold is used for motor vehicles on the highway system. Thus, it is necessary to estimate and exclude sales for farm purposes, generators, recreational boating, lawnmowers, snowmobiles, etc. This can be done to a limited degree by deleting tax-free sales which allegedly are being used for farming. Assuming that such figures are not inflated, a problem that would be greater in a rural state than in a predominantly urban one, an attempt must be made to estimate the other uses, including activities which vary from one community to another, one season to the next, and from year to year.

The net gasoline sales obtained after these deletions must then be converted to an average miles per gallon. Here too there are problems in estimation because usage rates differ with type and age of vehicle, load carried, type of road, and season of the year. Thus, again, there are so many confounding variables as to make accurate estimation virtually a chance phenomenon.

And what is available when a mileage figure is finally obtained? The administrator has a single figure that can be used only to describe, and describe poorly at that, total exposure for an entire state over a specific time period. It can give no information about single communities, relative exposure by age, sex, race, type of vehicle, hour or day of week, type of road, or any of the other circumstances that are so important to program planning.

The second method is the household interview which can be carried out face-to-face or by mail. Both approaches have been used with some success for studies in selected populations. The advantages of this method are that it is possible to relate mileage information to driver characteristics, type of vehicle, and community of residence. The disadvantages are the following:

1. Most people have difficulty in accurately assessing their annual driving exposure.⁵ Below 10,000 miles per year they appear to tend to round out to the nearest 1000 miles, with overrepresentation at 5,000 and 10,000 miles. The next tendency is to round out to 1000 miles per month, such as 12,000, 24,000, or 36,000 miles per year. People also estimate to the nearest 5000 miles, thus giving groupings at 15,000, 20,000, 25,000, etc. Furthermore, if two or more drivers use a single car, or one driver uses two or more cars, the estimating process becomes more tenuous.

2. It is especially difficult for people to estimate what proportion of their mileage occurs at certain times, for certain purposes, or specific types of roads.

To some extent these problems can be avoided by having people record and report on their driving behavior for specific 24-hour periods. This is much more likely to be accurate, provided these 24-hour periods are properly distributed over enough areas of the state and times of the year to give a good total estimate.

3. One problem that household surveys cannot overcome is the absence of information about non-residents who may be driving in the area under study. In particular, this would exclude most large trucks and buses, and many drivers who would be at risk in areas with important interstate highways, areas used for recreational purposes, or industrial areas whose residents live in bedroom communities located elsewhere, such as in a neighboring state.

The third method usually does not give total exposure, but rather estimates relative exposures. This is the roadside survey in which observations are made either with or without stopping cars for occupant interviews. Such surveys can give data about the numbers and types of vehicles per hour on specific categories of roads, and at specific times. If vehicles are stopped, information can also be gotten about occupant and trip characteristics, and further information can be obtained about the vehicle itself. The

advantages of the survey I am discussing here, although it is inexpensive.

What are the limitations of the roadside survey approach? First, surveys are relatively expensive, although costs can be minimized by using existing personnel or by collaborating with various local universities which may be interested in training students in survey methods. Perhaps the biggest limitation is that it is difficult within usual budgets available to select enough sites over enough time frames to provide a truly representative sampling of a community, much less of an entire state.

Our own experience with roadside surveys to test for alcohol is that such surveys can be carried on for only an hour at any one site. Beyond that, the public becomes aware of the activity and certain people begin to avoid the road while others come as volunteers. This may not be a problem if the survey does not involve the implied threat of alcohol testing.

Mention should also be made of the "induced exposure" method for estimating the population at risk. This technique will be described only briefly because it is still very much an experimental procedure, although preliminary data suggest that not only is it likely to be relatively inexpensive, but it may be fairly accurate as well.¹⁴

Induced exposure is based entirely on data available from highway crashes. Using such data it is assumed that vehicles in single vehicle crashes and "responsible" vehicles in two-vehicle crashes are so involved not so much because of exposure to the highway environment but because of "innate qualities" of the driver-vehicle category. The non-responsible or "innocent" party, however, is presumed to be involved in the crash simply because of exposure. Therefore, if the induced exposure method is correct, analysis of characteristics of non-responsible drivers and vehicles in crashes should give relatively accurate information as well about the relative exposures of different types of drivers and vehicles not in crashes.¹⁵

Choosing the Best Method

So far, we have identified the importance of adequate exposure and other denominator information, some of the problems in defining exposure, and various methods used to arrive at exposure estimates

sort through these and indicate what decisions I might make as an administrator to obtain maximum information about exposure at minimum cost using the three methods that are no longer experimental.

Although estimates based on gasoline sales are inexpensive to arrive at, they are in my opinion capable of providing so little information of such unknown validity that I would not use them at all for program planning, that is for gathering baseline and follow-up exposure information over a period of years. Roadside surveys have greater initial cost, but if carried out periodically on selected representative roads over the range of seasons, hours, and days of the week can provide highly accurate information, limited only by variations attributable to sample size, about such questions as number of vehicles per hour (as estimates of relative mileage from one time frame or location to another), characteristics of drivers and passengers, trip purpose, start and destination, and characteristics of vehicles.

The sites for surveys should be chosen so that they represent urban, suburban, and rural locations and both freeway and nonfreeway roads. Since the sites selected are to be sampled periodically over a number of years, care should be taken to avoid sections of road that are likely to be subjected to changing use patterns because they are in changing neighborhoods, will be affected by the planned construction of other roads, etc.

While not providing total vehicle mileage, something that the gasoline-sales method can't do either, the roadside survey can provide a very wide array of exposure information which can be further enriched by correlation with 24-hour vehicle counts at these sites, motor vehicle registration and driver licensing data, etc. Also, additional questions can be added at these surveys from time to time in preparation for proposed new countermeasures or in response to unanticipated occurrences such as the fuel crisis of 1974. It is a sad commentary that no such system for representative measurement of exposure existed at that time anywhere in the nation. Consequently, many important questions about driver behavior previous to and in response to that event remain unanswered to this day. Let us hope, and actively work to ensure, that such a defect in data gathering soon becomes a thing of the past.

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ABSTRACT CITATIONS

CONSIDERATIONS IN THE USE OF SAMPLING PLANS FOR EFFECTING COMPLIANCE WITH MANDATORY SAFETY STANDARDS. FINAL REPORT

The role of sampling plans in product compliance testing and their relationship to mandatory product safety standards is formulated and discussed. An attempt is made to synthesize the principal factors affecting the public interest into a comprehensive view. The technical questions and policy issues that a regulatory agency must resolve in order to develop suitable set of statistical sampling procedures are examined. The following means for a regulator to gain compliance are discussed: processing of complaints about injurious and defective products leading to recall, to other administration action, or to support of liability litigation; off-shelf market place sampling leading to further action such as an investigation of the manufacturer's quality control procedures or to direct administrative legal action; voluntary sampling or other quality control assurance provided by the producer; in-plant mandatory sampling prescribed by the regulator; and prototype testing prior to production.

by J. H. Winger; V. L. Broussalian; A. J. Farrar; J. W. Lyons; C. O. Muehlhause; M. G. Natrella; J. R. Rosenblatt; R. D. Stieher
National Bureau of Standards, Washington, D.C. 20234
Rept. No. NBSIR-75-697 ; 1975 ; 59p 24refs
Availability: NTIS \$4.25

HS-017 427

TIRE-PAVEMENT FRICTION AS A FUNCTION OF VEHICLE MANEUVERS. FINAL REPORT

Limit maneuvers (steady state turns, straight line braking, braking in a turn, and avoidance maneuvers) were performed on different wet pavements with disparate passenger vehicles (1964 Ford Custom sedan, 1971 Volkswagen Superbeetle, and a 1971 Ford Custom sedan), and the vehicle-available acceleration was compared with pavement friction indicators. The vehicle instrumentation (accelerometers, rate gyros, fifth wheel, steering angle limiter, wheel rotation sensors, brake pressure limiter, and timing) is described. Maximum vehicle accelerations, acceleration as a function of skid, the effect of tire variables (various combinations of tread depth and air pressures), water depths, and hydroplaning are discussed. Reasonably conservative estimates were made of vehicle cornering and/or stopping capability as a function of skid number measured at 40 mph. It is concluded that a drastic reduction in maneuverability occurs within a few mph above some critical speed (as low as 45 mph) for a given set of conditions; and the estimates made herein can be used to realistically evaluate pavement friction for expected maneuvers at individual roadway sites.

by Gordon G. Hayes
Texas Transportation Inst., Texas A and M Univ., College Station, Tex. 77843
Rept. No. TTI-2-10-72-163-2F ; 1974 ; 95p 17refs
Rept. for Sep 1971-Oct 1974. Sponsored by the Texas Hwy. Dept. in cooperation with the Federal Hwy. Administration.
Availability: Texas Hwy. Dept., 11th and Brazos, Austin, Tex. 78701

BICYCLE INJURIES: ONE-YEAR SAMPLE IN CALGARY [CANADA]

Hospital and police records of 107 injured bicyclists in Calgary, Alberta, Canada, were examined. It was found that: 73(67%) of the bicyclists sustained craniocerebral trauma; upper-limb injuries comprised the second largest group (18%); 7% had lower-limb injuries; the 107 patients were hospitalized for a total of 381 days; there were four deaths, all due to acute subdural hematomas; 20% of the injuries involved collision with an automobile; males had one and one-half times as many injuries as females; the highest frequency of male injuries was in the 11-15 year old age group; and the fatalities were all male.

by Donald M. P. Guichon; S. Terence Myles
Publ: Journal of Trauma v15 n6 p504-6 (Jun 1975)
1975 ; 3refs
Availability: See publication; S. Terence Myles, M.D., Dept. of Surgery, Foothills Hosp., Calgary, Alta., T2N T9 Canada

HS-017 429

TECHNOLOGY SPOTS THE SPEEDER

The bases for legal challenges to the use of photographic speed detection devices by law enforcement are reviewed: whether their operation violates an individual's constitutional right of privacy; whether the operational limitations of such devices create impermissible inequities in traffic law enforcement; and assuming the devices overcome these potential challenges, whether their photographic products are admissible as court evidence. Relevant court cases are cited. One particular case started in the county court of Arlington, Texas is mentioned as the first challenge to these devices. If, in this case, earlier convictions are upheld, such photographic devices may become common features on the highways.

by David S. Glater
Publ: The Urban Lawyer v7 n1 p115-27 (Winter 1975)
1975 ; refs
Availability: See publication

HS-017 430

CRASH CUSHIONS OF WASTE MATERIALS

Research concerned with the incorporation of scrap tires and other waste materials in crash cushions is described. Six full-scale crash tests, sometimes in combination with pendulum and static testing and computer simulations, were conducted on two basic crash cushion designs. One design consisted of scrap automobile tires stacked and in layers and the other was an adaptation including "fish scale" side panels to redirect vehicles in side impacts. A tire-sand crash cushion (stacked tires filled with sand), a tire-beverage can crash cushion (filled with scrap aluminum cans) and a fiberized aluminum material for filling tires were tested. Impact was achieved by towing vehicles into both direct frontal and angular side crashes at about 60 mph. High-speed cameras, accelerometers measuring longitudinal and transverse vehicle movement, a strain gauge measuring seat belt forces applied to an anthropometric dummy, and an impact-o-graph were used to record data. It is

concluded that: module assemblies of scrap tires can serve as effective crash cushions and when modified with "fish scale" sides (30 foot plywood siding) are even more effective where redirection capabilities are required; a satisfactory tire crash cushion, found to remove up to 400 scrap tires from existing stockpiles, is a good method for reducing accumulated wastes; the supports for a tire-sand cushion should be between 10 and 15 inches high in order to place the center of gravity at the proper location with respect to the center of gravity of the average automobile; cardboard carton supports should have metal edges on the rims and be waterproofed; and tires filled with sand should be waterproofed to keep the sand dry. The tire-berage can crash cushion was indicated by analytical and laboratory study to have potential for good vehicle impact attenuation. The fiberized aluminum crash cushion also seemed to be satisfactory, although the relatively high cost is a negative factor.

by E. L. Marquis; T. J. Hirsch; C. E. Buth
Texas A and M Univ., College Station, Tex.
Rept. No. NCHRP-157; 1975; 80p 15refs
Availability: TRB \$4.80

HS-017 431

CRASH HELMETS FOR MOPED RIDERS

Descriptions of moped owner characteristics, and of road risks for moped riders, including accident, injury, and fatality rates, are given. Also included are: the number and nature of injuries to moped riders, with emphasis on skull and brain injury; the positive and negative effects of wearing a helmet; ownership and use of helmets by moped riders; the way in which the standards for moped crash helmets were established; and recommendations on how to buy and wear crash helmets.

Institution for Road Safety Res. SWOV, P.O. Box 71,
Deernstraat 1, Voorburg 2119, The Netherlands
Rept. No. Pub-1975-1E; 1975; 20p
An abridged version of the two part report "Helmets voor Bromfietzers".
Availability: Corporate author

HS-017 432

THE PERCEPTION OF VEHICLE SPEEDS BY PEDESTRIANS

Experiments into pedestrian perception of vehicle speeds were carried out on a busy street in central London, England and on a section of a four-lane thoroughfare with free-flowing traffic subject to a 40 mph speed limit. Seven volunteer subjects, grouped on the pavement, were asked to record estimates of a certain vehicle speed as it passed a reference point. Observations of 50 vehicles were made at each site. Then the subjects were moved and 50 more observations were made at a different angle to the reference point. The average speed of the vehicles observed was 32 mph and the average of the estimated speeds was 31 mph. The average errors of the seven individuals ranged from 02 mph to -6 mph. The standard deviation of estimated minus true speed was about 5 mph for all subjects and there was a tendency for observers to underestimate high speeds.

by P. B. Goodwin; T. P. Hutchinson; C. V. Wright
Publ: Zeitschrift für Verkehrssicherheit v21 n1 p13-8 (1975)
1975; 3refs
Includes German and French summaries.

HS-017 433

VEHICLE DIAGNOSTIC STATION

The SDA-70 Vehicle Diagnostic Station is discussed. The station is designed for testing GAZ and ZIL vehicles without disassembling them. Using three generators, the stand measures 80 to 90 parameters and recognizes 130 to 150 deficiencies, depending on the vehicle being tested. The stand includes a dynamometer for testing of power and braking, and facilities for checking wheel and axle alignment. Preliminary calculations of the economic effectiveness show that the introduction of the type SDA-70 station will allow labor consumption to be reduced by 4.92 man hours and the following effects to be obtained: 20% from reduction of dead time of vehicles in on-going repair as a result of timely exposure of deficiencies in the separate units; 14.2% from savings in reserves of parts and materials, created as the result of increased quality of servicing of reliably determined deficiencies; and with the manufacture and introduction of a test-industrial lot of the SDA-70, servicing a transport enterprise with a fleet of up to 1,000 transport units, the annual economic effect from a single station comprises 47,200 rubles, and the period of recovery is one and one-half years.

by V. Demidov
Publ: Avtomobil'nyy Transport (USSR) n10 p29-30 (1972)
Rept. No. AD-A008-250-3; 1974; 8p
Translated from Russian under Dept. of the Army contract.
Availability: NTIS

HS-017 434

OCCUPANT MODEL FOR HUMAN MOTION

A two-dimensional model of a human being appropriate for display on a computer graphic terminal is described. The model was designed for use with the PROMETHEUS program which predicts occupant positions within a vehicle during a crash, but can also be used to simulate other human motions. The design of a simple device to automatically generate movies from a terminal screen is also presented. Triggered by a bell on the terminal, one frame is taken of each position of any time-varying event, thus creating a movie depicting simulated motion.

by Kenneth D. Willmert
Clarkson Coll. of Technology, Dept. of Mechanical and Industrial Engineering, Potsdam, N. Y. 13676
Contract N00014-70-A-0311-0003
Rept. No. MIE-009; 1974; 31p 2refs
Rept. for Feb 1973-Jul 1974.
Availability: Office of Naval Res., Arlington, Va.

HS-017 435

USER MANUAL FOR THE TRAFFIC ACCIDENT RECORDING MODULE

A user manual for the traffic accident recording module is presented. This manual for the City of Reading, Pa. system includes portions on the traffic accident report (a general description, organizational responsibilities for maintenance, data entry and resultant reports); and a detailed user requirements section, including portions on the traffic accident recording module, bureau of police and bureau of management services. An appendix includes instructions for completing accident reports; and the traffic accident summary. Computer

City of Reading, USAC Proj., P. O. Box 7, Reading, Pa. 19603
Contract HUD-H-1212
Rept. No. USAC-RPA5-7052 ; 1975 ; 59p
On cover: "The Physical and Economic Development
Subsystem for Reading, Pennsylvania."
Availability: NTIS

HS-017 436

DEATH AND INJURY ROAD ACCIDENTS IN NORTHERN IRELAND, 1974

Road accidents involving death or injury which occurred in Northern Ireland during 1974 are reported. Statistics are presented in graphs giving: monthly accidents 1973-1974 for Northern Ireland and Belfast; yearly accidents 1967-74; accident responsibility; ages of child casualties for Northern Ireland and Belfast; alcohol and accidents; driving experience and motorcyclists; and death and injuries by hour of the day. Tables list: total accidents involving death and injury by times, day of the week, age, type of road user killed or injured; characteristics of persons at fault; principal factors including drivers of motor vehicles, motorcyclists, pedal cyclists, drivers of other vehicles, pedestrians, mechanical defects, and miscellaneous factors; summary of factor tables; accidents by condition of light and weather, road characteristics, licensing of drivers, registration, month, type of vehicle involved, and restricted and unrestricted roadways.

Royal Ulster Constabulary, Traffic Div. Headquarters,
Alexander Rd., Belfast, Northern Ireland
1975 ; 52p
On cover: "Road Accidents Report, 1974."
Availability: Corporate author

HS-017 437

TEST VARIABILITY OF EMISSION AND FUEL ECONOMY MEASUREMENTS USING THE 1975 FEDERAL TEST PROCEDURE

The results of replicate tests using the 1975 Federal Test Procedure (FTP) on the engines of a 1971 Ford Ranchwagon, a 1973 Opel 2100 D, a 1972 Mercedes 220 D, a 1975 Ford LTD, and a 1974 Vega are discussed. The following types of emission-control systems were tested: the conventional control system; the diesel fuel injection control system; the stratified-charge combustion system; and the oxidation catalyst control system. The test variability of the 1975 FTP is assessed and quantified. The overall variabilities of the 1975 FTP composite values have been assessed at plus or minus 6% for hydrocarbons and carbon monoxide, plus or minus 3% for nitric oxides, and plus or minus 1% for carbon dioxide (CO₂). The extremely repeatable behavior of the CO₂ emissions is utilized to calculate fuel economy during the test. This calculation is discussed and some fuel economy results from repetitive tests (for 1975 Gremlins, Vegas, and Saabs with and without air conditioning) using both the 1975 FTP and the Highway Fuel Economy Test are presented.

by C. Don Paulsell; Ronald E. Kruse
Environmental Protection Agency
Rept. No. SAE-741035 ; 1974 ; 20p 6refs
Presented at the Automobile Engineering Meeting, Toronto,
Canada, 21-25 Oct 1974.
Availability: SAE

HS-017 438

ADVANCES IN LOW TEMPERATURE LIQUID NITRIDING

Low temperature liquid nitriding, performed in a carbon and nitrogen fused salt bath as a single step hardening process, is discussed. The two hour heat treatment produces substantial endurance and wear properties. Applications of the process to medium and small car production are considered: crankshafts, camshafts, valves, rocker arms and rocker arm shafts, shifter forks, connecting rods, differential housings, and gears. Possible uses of low temperature liquid nitriding in future engines and the energy conservation properties of the process are discussed. It is concluded that: for those automotive components having a need for fatigue improvement, wear and corrosion resistance, under suitable operating conditions, low temperature liquid nitriding holds great promise; and salt bath processes can easily be operated on a small scale for selected applications or conveniently automated to meet high production requirements.

by Robert H. Shoemaker
Kolene Corp.
Rept. No. SAE-750195 ; 1975 ; 12p
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 439

PRACTICAL APPLICATION OF FORWARD EXTRUSION THEORY

Progress made in the practical application of various extrusion theories is reported. The formulae that have proved successful in use on production parts are presented. Main emphasis is given to the forward extrusion of metal through conical converging dies and the related process of wire-drawing. Consideration is also given to the commonly used materials that are extruded and the lubricants used. It is concluded that: by using an assumption of a forward extrusion flow field that fits closely to reality, an acceptable die geometry can be found that will permit determination of strain, material strength, and tool load; and the chevron-free angle now developed allows a producer to process almost any material required, regardless of quality, and know that the part will be sound.

by Michael E. Ward
Chrysler Corp., Engineering Office
Rept. No. SAE-750196 ; 1975 ; 8p 13refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb. 1975.
Availability: SAE

HS-017 440

SHEET METAL STRETCH FLANGE ANALYSIS: A MANUFACTURING VIEWPOINT

Sheet metal forming difficulties often stem from splits in flanges. A technique to analyze strain at flange edges is described. The effects of stress concentrators, that is, tabs and cutouts, and burrs are shown. Some edge strain limits are also presented. The use of the equations and strain limits presented enables designers to evaluate flange designs prior to final tooling construction. These evaluations improve the compatibility between flange design and material formability and result in

by A. S. Kasper; W. L. Weeks; M. P. Borden
Chrysler Corp.
Rept. No. SAE-750197; 1975; 8p 1ref
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 441

EFFECTS OF GRAPHITE MORPHOLOGY, MATRIX HARDNESS, AND STRUCTURE ON THE FATIGUE RESISTANCE OF GRAY CAST IRON

The fatigue resistance of gray cast iron is shown to be strongly dependent on graphite morphology and the strength of the steel-like matrix. Considering graphite flakes in gray iron as internal notches, a comparison is made of the fatigue resistance of gray irons and steels of comparable composition, hardness, and microstructure. The following systems are investigated: SAE 9262 steel (pearlitic matrices, and martensitic matrices of two different average hardnesses); and gray cast irons (pearlitic matrices with coarse, fine, and mixed graphite, and martensitic matrices with coarse, fine, and mixed graphite). Application of a Neuber analysis, previously employed in geometrically notched members to relate nominal stresses and strains to local stresses and strains at notch roots, produces quantitative values of the fatigue notch factor for various graphite morphologies, matrix structures, and hardnesses. Fatigue resistance of gray irons is enhanced by decreasing graphite flake size. Matrix hardness is of greater importance than structure in determining the fatigue resistance.

by M. R. Mitchell
University of Illinois, Dept. of Theoretical and Applied
Mechanics
Rept. No. SAE-750198; 1975; 15p 12refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 442

CRC EVALUATION OF TECHNIQUES FOR MEASURING HYDROCARBONS IN DIESEL EXHAUST. PHASE 4

The fourth in a series of programs evaluating techniques for measuring the concentration of hydrocarbons in diesel exhaust, carried out in 1972 and 1973, is reported. A direct injection, 6-cylinder, four-stroke diesel engine of 301 cubic inches displacement was used as part of a generating set including an electrical control panel, fuel tank and exhaust silencer mounted on a flat-bed truck. The generating set was circulated among 15 participating laboratories and each laboratory measured exhaust hydrocarbons four times at each of three power settings. They also measured the hydrocarbon concentrations of two bottled gases of unknown compositions. Analyses were fairly consistent within laboratories both on bottled gases and engine exhaust. The standard deviations were 3% and 10% of the grand averages, respectively. Analyses differed substantially among laboratories both on bottled gases and engine exhaust with the standard deviations at about 10% and 22% of the grand averages, respectively. These results scatter more than is desirable for engineering measurements, and they indicate that further improvement should be sought in techniques for analyzing hydrocarbons in diesel exhaust.

by T. O. Wagner; L. C. Broering; J. H. Johnson
American Oil Co.; Cummins Engine Co., Inc.; Michigan
Technological Univ.
Rept. No. SAE-750203; 1975; 10p 5refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 443

COOPERATIVE EVALUATION OF TECHNIQUES FOR MEASURING NITRIC OXIDE AND CARBON MONOXIDE (PHASE 4 TESTS)

The results of the fourth in a series of test programs evaluating the measurement methods used to analyze nitric oxide (NO) and carbon monoxide in diesel exhaust are presented. A 6-cylinder, 4-stroke direct injection engine with 301 cubic inches displacement was used as part of a generating set including an electrical control panel, fuel tank, and muffler mounted on a flat bed truck. The engine was circulated to 15 participants who measured emissions four times at each of three power settings. Several laboratories measured NO by both non-dispersive infrared and chemiluminescence and some also measured carbon dioxide, nitrogen dioxide, oxygen, and unknown span gases. No restrictions were placed on the type of measurement equipment used. It is concluded that: the precision of the results is poorer than previous tests where all participants simultaneously analyzed the exhaust; results are complicated by some variation in the emissions generator and poor calibration and operating procedure by some labs; the NO data obtained by chemiluminescence analyzers are significantly lower than by the more standardized non-dispersive infrared method; and some improvement should be feasible with good calibration and operating practices.

by J. M. Perez; L. C. Broering; J. H. Johnson
Caterpillar Tractor Co.; Cummins Engine Co.; Michigan
Technological Univ.
Rept. No. SAE-750204; 1975; 12p 6refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 444

DIESEL EMISSION CONTROL THROUGH RETROFITS

Exhaust emissions from in-use diesel trucks and buses can be reduced by the application of retrofits consisting of new parts and adjustments. The results of fleet test demonstrations of two retrofit kits, one for 2-stroke diesel-powered buses and the other for 4-stroke diesel trucks, are described. A thorough evaluation of exhaust odor, smoke, gaseous emissions, and noise for each in-use vehicle was made before application of the retrofit. A two-year, three-bus demonstration was carried out from 1970 to 1972. The retrofit kit included: a catalytic muffler with copper oxide-coated alumina spheres; a fuel injector with a needle type valve; a vertical exhaust stack; an intake air system with a larger dry type air cleaner; and replacement engine mounts to reduce engine vibrations. Odor, smoke and gaseous emissions inspections were made five times during the two years. An eight-month, three-truck (1969, 1970, and 1971 White Freightliners) field demonstration was conducted in 1972. Cummins turbokits were installed and the injection pumps on the trucks were recalibrated. It was found

that: the main importance of the needle type fuel injectors and vertical stack items in the bus retrofit kit was reduction of city bus odor; the major claim of the Cummins turbokit was the virtual elimination of visible smoke from the trucks; and both kits, by virtue of improved combustion, increased oxides of nitrogen. The catalytic mufflers were removed from the buses because, early in the testing, they proved ineffective.

by Karl J. Springer; Ralph C. Stahman
Southwest Res. Inst.; Environmental Protection Agency
Contract Ref: PH-22-68-23
Rept. No. SAE-750205 ; 1975 ; 16p 13refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 445

TEMPERATURE MEASUREMENT FOR ADVANCED GAS TURBINE CONTROLS

Modern gas turbine engines with turbine inlet gas temperatures (TIGT) higher than metal melting temperatures must have control systems which provide subsecond response to changes in gas or metal temperatures. High quality data are required to provide for the most efficient engine operation consistent with engine safety. Some of the turbine blade temperature sensing and TIGT measurement systems being developed for turbine engine control are described. Radiation pyrometry is discussed. It is used to measure turbine blade temperatures and has been advanced to the production-prototype stage for aircraft engine control and diagnostic analyses. The use of high-temperature fiber optics, advanced sapphire brazing techniques, and miniature hybrid electronic circuits have allowed this precision instrument to be hardened for aircraft and industrial engine installation. TIGT measurement systems for advanced engines are still in the laboratory stage. Beta-ray gas temperature density probe (GTD) and ultrasonic air-gap are the two non-immersion concepts that appear feasible. A sensor concept using a passive radiation target for a brightness pyrometer was the only immersion type considered feasible for engine control. Results of the latest experimental developments for the GTD and immersed radiation target indicate that these concepts have the potential to measure turbine inlet temperatures over a range of 540 C - 1650 C. Output from these sensors can be used for gas turbine engine control.

by David A. Rohy; T. E. Duffy; W. A. Compton
International Harvester Co., Solar Div. San Diego, Calif.
Contract N00010-69-C-0683; N00019-71-C-02888; AIR-330E;
F33615-71-C-1510
Rept. No. SAE-750206 ; 1975 ; 16p 5refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 446

TEMPERATURE MEASUREMENT FOR GAS TURBINE ENGINES

The most commonly used techniques and hardware for temperature measurement and control in gas turbine engines are reviewed. Gas turbine engines may be classified as fan jet, free turbine turbo-shaft, or single spool turbo-shaft engines. Most engines today use some system involving thermocouples to measure temperature for manual or automatic control. The makeup of thermocouples in use today is discussed; their

mocouple probes (bare wire junction assembly, enclosed tip assembly, gold-palladium bare wire junction assembly, sampling type probe, and stagnation probe); and harness assemblies to keep conductors isolated from each other and from the ground and protected from the environment (single harness, and common point harness systems). General observations are made on the location of the thermocouple in each type of gas turbine engine.

by W. J. O'Brien
General Motors Corp., Detroit Diesel Allison Div.
Rept. No. SAE-750207 ; 1975 ; 10p
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 447

PERFORMANCE AND APPLICATION OF THE EXDUCER POWER TURBINE

The development of a two-shaft gas turbine engine in which the exducer portion of the radial inflow turbine was employed as a nozzleless free power turbine is reviewed. The performance results obtained while operating the engine over a range of compressor and power turbine speeds are presented. A performance evaluation was carried out with a 14-bladed rotor and 12-bladed exducer covering operation at gas generator speeds of 60, 70, 80, 90, 95, 97.5, and 100% rated and at various power turbine speeds to map the exducer turbine characteristic. A comparison is made between the performance of the original engine and a second generation unit. Peak total-to-static power turbine isentropic efficiency is estimated to be 77% which could be increased to nearly 80% with an uncompromised geometry optimized using current radial inflow turbine aerodynamic performance techniques. It would appear that such a turbine configuration would be suited for application to small gas turbine starters where performance compromises are permissible to realize low cost and minimum component numbers.

by Colin Rodgers
International Harvester Co., Solar Div.
Rept. No. SAE-750208 ; 1975 ; 18p
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 448

EARLY DETECTION OF DEFECTS IN ROLLING-ELEMENT BEARINGS

The results of studies demonstrating the feasibility of the high-frequency resonance technique (HFRT) for defect analysis of rolling-element bearings in bearing systems are presented. Emphasis is placed on helicopter engine and transmission applications. The HFRT is a method for separating ball-pass or roller-pass frequency peaks from background noise by isolating and demodulating high frequency spectrums of accelerometer signals. Tests were conducted with the following bearings from a UH-1 helicopter transmission: two input bevel gear shaft ball bearings, two lower-stage sun gear shaft roller bearings, and an upper mast bearing. The test bearings were mounted in a rotating dynamic response test rig and run under various conditions of speed, load, and bearing housing design. Accelerometers were used for signal recording. Data were

such as an order of magnitude increase in the amplitude of the ball-pass or roller-pass frequency peaks for the bearings with artificially-induced, discrete defects as compared to the same bearings without defects. Variations in speed and load were found to have little effect on the defect signals' magnitude. Similar signals were recorded on an operating UH-1 helicopter main rotor drive during ground tests. It is shown that the HFRT can readily detect bearing defect signal components in the presence of high background noise levels.

by Mark S. Darlow; Robert H. Badgley
Mechanical Technology Inc.
Contract DAAJ02-73-C-0086
Rept. No. SAE-750209; 1975; 14p
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 449

NEW TRANSIT MODES: APPLICABILITY AND CURRENT STATUS

Four new urban transportation modes are discussed: moving way transit (MWT), light guideway transit (LGT), personal rapid transit (PRT), and dial-a-bus (DAB). The various operating locations of these modes are listed. It is concluded that: LGT is at the state-of-the-art level; accelerating MWT systems are at an awkward state with respect to the marketplace; high capacity PRT appears to be no less than four years away from the state-of-the-art level; and DAB systems are now operational. Applying the various systems to generalized urban scenarios, it is found that: DAB is best applied in local clusters which are residential neighborhoods; MWT is best applied in major activity centers; PRT and LGT are more suitable for local clusters which are commercial and/or industrial centers; PRT would be more effective for collection and distribution in large areas where lines are widely spaced; and LGT would be most effective in corridors, for express service, where higher capacities are required.

by Charles P. Elms
N. D. Lea Transportation Res. Corp.
Rept. No. SAE-750214; 1975; 20p 3refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 450

THE EFFECT OF AUTOMATIC TRANSMISSIONS ON MILITARY TRUCK FUEL ECONOMY

Investigations made of military truck fuel economy with various types of transmissions are described. A 2 1/2 ton 6x6 truck powered by a 140 horsepower multi-fuel engine was used for the test. Engine, axle, tire, induction and exhaust system, and instrumentation modification were made to four of these vehicles. Three test courses were selected to represent highway (50 miles of interstate highways), secondary road (114 miles of 60% paved rural and county roads with 47 stops), and cross-country terrain (1.8 mile route in soft sand with grades up to 13.5%). A professional driver was assigned to each vehicle and the trucks were operated together on each course, alternating the lead every four hours. Four different transmissions were installed for evaluation: a four speed hydrokinetic with torque converter lock-up clutch, fully automatic ratio selection with

without torque converter lock-up clutch, manual ratio selection; a two range hydromechanical, continuously variable, fully automatic transmission; and a ten speed mechanical, manual ratio selection, nonsynchronized transmission. It was found that: for a military duty cycle in which a combination of terrains is expected hydrokinetic transmissions with torque converter lock-up clutches, hydromechanical transmissions, and manual transmissions will provide comparable fuel economy when operated by professional drivers over known routes; fully automatic hydrokinetic transmissions with torque converter lock-up clutches and hydromechanical transmissions, due to their automatic ratio control, can be expected to provide superior fuel economy in the military environment where driver experience is limited and unfamiliar terrain is occasionally encountered; and hydrokinetic transmissions without torque converter lock-up clutches will not provide comparable fuel economy under highway and secondary road operations.

by Wayne K. Wheelock
Army Tank-Auto. Command
Rept. No. SAE-750216; 1975; 7p 1ref
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 451

A CYBERNETICALLY COUPLED RESEARCH VEHICLE [CCRV]

Performance testing is described for an experimental vehicle (the CCRV) which couples two M-113 armored personnel carriers with a cybernetically controlled articulation joint. The CCRV is able to: climb vertical steps up to 5 feet high; cross trenches up to 10 feet wide; climb a 60% slope of 15 feet in length with soil cohesion of 10 pounds per square inch and internal friction angle of 25; turn in a radius of 40 feet on hard ground; cross a 2 1/2 foot high obstacle at 2 1/2 mph; be controlled from either front or rear unit; enter into, cross, and exit from inland waterways not possible for single M-113; and have force feedback capability when negotiating vertical obstacles. The following performance factors were evaluated: movement over vertical steps and open trenches; operation in sand and snow; maneuverability on land and in water; exiting from deep water; and land speed and ride. It is concluded that: CCRV's performance is generally superior to that of the single vehicle, especially in crossing vertical obstacles and trenches and in water egress capabilities; and only in hard ground maneuverability is the single vehicle, with its pivot steer capability, superior to the CCRV, with its powered yaw articulation.

by Ronald R. Beck; Irwin O. Kamm
Army Tank-Auto. Command; Stevens Inst. of Tech.
Contract DAAEO7-72-C-0164; DAAEO7-74-C-0185
Rept. No. SAE-750217; 1975; 11p 4refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 452

THREE GENERATIONS OF SOVIET WHEELED MILITARY TRANSPORT VEHICLES

The development of the Soviet Union's wheeled military transport vehicle fleet since World War II is analyzed as three

generations. The 21 vehicles included in these generations are identified and characterized. Vehicle design details are described in terms of overall vehicle mobility, efficiency, and durability. Trends in component design which affect vehicle mobility, efficiency, and durability are presented. Efficiencies of Soviet heightened mobility military transporters have steadily improved. The durability of these transport vehicles is expected to reach 240,000 kilometers in the next five years.

by Donald R. Warner
United States Army
Rept. No. SAE-750219 / 1975 / 10p
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 453

EVALUATING THE EFFECTS OF CORROSION ON STRUCTURAL MATERIALS. A STUDY OF PLAIN CARBON AND HIGH STRENGTH LOW ALLOY STEELS

The effects of uniform corrosion on the structural properties of high strength low alloy (HSLA) steels are reported and the importance of including mechanical tests when rating the corrosion performance of structural materials is shown. Hot rolled steel samples (1 1/2 x 8 inches) of 7 HSLA steels and one plain carbon steel received a solvent wash and were subjected to a cyclic humidity test producing corrosive attack resembling the uniform underbody corrosion occurring in the field. Triplicate, or, in a few cases, duplicate samples of each steel were tested for periods of 24, 40, and 100 days. After these exposures, the corrosion products were removed and weight losses determined. Tensile test specimens were machined from these corroded samples, and tension tests were conducted at a crosshead rate of 0.2 inches per minute. The corrosion rates, load carrying ability, and ductility of these corroded steels are discussed. It was found that the tensile load carrying ability and ductility of plain carbon and HSLA steels are reduced by uniform corrosion, with reductions being more rapid with, respectively, the higher strength and thinner materials. As a result, corrosion prevention can be more important for structures made from HSLA steels, particularly when use of a HSLA steel has resulted in designs with reduced material thickness.

by William K. Miller
General Motors Corp., Res. Labs.
Rept. No. SAE-750220 / 1975 / 8p 4refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 454

EFFECTS OF THE 55 MPH SPEED LIMIT

Research was conducted to determine the effects of the nationwide 55-mph maximum speed limit (1973-1974) and to make recommendations for the American Association of State Highway and Transportation Officials' (AASHTO) position on future speed limits. Each of the six members of the AASHTO executive committee was assigned a group of states in his area and made responsible for data collection and analysis for those states. Data were collected from a number of states and

states and the District of Columbia, and analyzed by the committee. The history of motor vehicle speeds and speed limits, the theory and practice of setting speed limits, and the evolution of the 55-mph speed limit are discussed. It is concluded that: the 55-mph speed limit reduced speeds by up to 10 mph and resulted in more cars traveling closer to the average speed on a given road; vehicles miles were reduced about 5% from January to June 1974, compared to the same period in 1973, as a result of the fuel shortage; the lower speeds in 1974 reduced fuel consumption by about 3% or 3 billion gallons annually; in January through June 1974 there were about 20,000 traffic fatalities compared to 26,000 for the same period in 1973; the fatality rate dropped from 4.3 (per million vehicle miles) in 1973 to an estimated 3.4 for all of 1974; and reduced speeds, uniform speeds, reduced travel, improved driver behavior, daylight savings time, safety belt usage, better roads, better cars, and traffic safety programs all contributed to the reduction in fatalities.

American Assoc. of State Hwy. and Transportation Officials,
341 National Press Bldg., Washington, D.C. 20045
1974 / 50p 44refs
Availability: Corporate author

HS-017 455

METHOD OF CHECKING AND ADJUSTING BRAKES OF THE GAZ-21 ON THE BASIS OF BRAKING TIME

A stand developed to check braking effectiveness and uniformity in motor vehicle wheel brakes is described. The stand consists of: an electromechanical wheel drive (two running drums, electric motor, reduction gear, and chain drive); an electropneumatic measuring device (two devices for automatic depressing of the brake pedal and for measuring); guides; and a lift. Schematics are presented of: an overall view of the stand, the engineering plan for placement of the stand, and a device for automatic pressure on the brake pedal. The sequence for brake adjustment on the stand is fully detailed. The check of braking effectiveness is conducted according to braking time, beginning when the pedal is depressed and ending when the wheel is fully stopped. Tests of the stand and checks of its effectiveness on 60 GAZ-21 automobiles were conducted. The time for adjusting brakes on the stand was three times lower than adjusting and checking them by other methods. The total annual economic effect of using the stand in a Russian motor vehicle combine (Minsk) tentatively comprises 12,000 roubles per year.

by N. Lavrent' yev
Publ: Avtomobil' nyy Transport (USSR) n1 p25-6 (1972)
1974 / 8p
Translated from Russian under Dept. of the Army contract.
Availability: Dept. of the Army, Foreign Science and
Technology Center, 220 7th St., N.E., Charlottesville, Va.
22901

HS-017 456

DRIVER RECALL OF ROADSIDE SIGNS

On a flat section of two-lane highway with 55-mph speed limit, 200 car drivers were stopped by a uniformed traffic officer and asked (by a team of three interviewers) to recall the message on a worded traffic warning sign ("CHILDREN") they had just passed. Because of the poor recall of this sign it

veying the same warning, and an additional 200 drivers were stopped and interviewed. To ascertain the effect of a more complex environment on recall of the latter sign, and to determine the consequences of erecting a series of signs with different messages on a single short stretch of road, the procedure was repeated with the symbolic warning sign being one of a series of three warning signs and an advertising sign (each sign 240 feet apart). The positions of the signs in the series were varied systematically and 200 drivers were interviewed for each serial order. Variables considered were: sex of driver, presence of passengers, distance driven prior to being interviewed, number of years driver had held license, age of vehicle, and familiarity with the road. Recall varied significantly from sign to sign, but in no case did the probability of free recall approach 0.50. Recall of the advertising sign was much worse than recall of the traffic signs. Other significant variables were distance driven prior to being stopped, number of years driver's license held, and familiarity with the road.

by J. E. Sanderson
Ministry of Transport, Traffic Engineering Sec., Private Bag,
Wellington, New Zealand
1974 ; 24p 17refs

Availability: Corporate author

HS-017 457

EXPERIMENTAL AND COMPUTER SIMULATION EVALUATION OF HEADLAMP BEAMS

The development of targets, suitable for use in dynamic field tests to measure visibility distances of drivers and to evaluate headlamp beams, is described. Two test vehicles were driven towards each other on a straight, flat road, free of other traffic. Each vehicle was equipped with a special front panel capable of mounting up to 14 headlamps. Lamps could be selected by means of switches which could be set for the orientation of each test target, so that the response made by the subject could be checked against the actual orientation of the target, on a given run. The response of the driver subject, and the passenger, when used, and other pertinent data were recorded on paper strip charts. Subjects indicated the position of the targets as they were seen. The time required for the car to run through the course was measured and vehicle speed was controlled. The distances at which the orientation of each target took place were determined as a function of the longitudinal separation distance between the vehicles at that instant. Visibility distances were obtained both before and after the meeting point. For low beams, a greater effect upon visibility distances of the target reflectances than the lateral separation distances was found. Increasing either produced an increase in visibility. Minimum visibility in the high beam meetings is less than that in low beam meetings. No significant differences in visibility distances were attributable to the speeds used (40 to 70 feet per second), although there was a tendency for the near visibility distances to be greater when the test was conducted at the lower speed. Test-retest reliability was investigated for the field test procedure itself, different test sites and drivers, and signs and targets. The effects of glare and the development of a mathematical model to predict visibility distances and compute glare values are discussed.

by Rudolph G. Mortimer

of the Transportation Res. Board, Columbus, Ohio, 4-6 Sep 1974.

Availability: Corporate author

HS-017 458

EVALUATING THE EFFECTIVENESS OF REEDUCATION PROGRAMS FOR CONVICTED [ALCOHOL] IMPAIRED DRIVERS

It has been argued that the evaluative model used to assess driver reeducation programs has not been the most appropriate and that by examining reeducation programs from the point of view of the social scientist's traditional approach we have limited our understanding of the implications and impact of such programs. Traditional and alternative approaches to evaluation are discussed. An evaluative approach to the Alberta Impaired Driver's Program emphasizing improving rather than proving is considered. It is concluded that if driver reeducation programs are here to stay, evaluation models must be used which make explicit and monitor the multiple objectives and activities of the functional units of these complex programs. Evaluation in terms of a single terminal criterion is not going to give a full assessment of the impact of reeducation measures.

by Peggy Brown; Paul F. Zelhart; Bryce C. Schurr
University of Alberta, Applied Psychology Unit, Edmonton
T6G 2E1, Alta., Canada

1974 ; 11p 8refs

Partially supported by the Ministry of Transport, Ottawa, Canada, and the Summer Temporary Employment Program of the Province of Alberta. Presented at the Sixth International Conference on Alcohol, Drugs, and Traffic Safety, Toronto, Canada, 8-13 Sep 1974.

Availability: Reference copy only

HS-017 459

MOTORCYCLE TRAINING FOR CALIFORNIA DRIVER LICENSING PERSONNEL. FINAL REPORT

A program providing all California driver license examining personnel with a course in motorcycle safety and principles of operation to enable them to more effectively evaluate motorcyclists' skills is described. The program methodology is discussed: project development (instructional modality, selection of examining personnel, selection of training consultant, training risks and liability insurance, and schedule and locations); presentation of the training course (work plan, specific task elements, and classroom and field training procedures); and the development of the motorcycle skill and road test system (authority, drivers license classifications, motorcycle skill and road tests, applicants' performance, test scoring method, and skill course pattern and test equipment). Pre-test and post-test written examinations given to the 702 applicants in the program indicated a substantial improvement in motorcycle knowledge. The costs of the program (allocations and expenditures) are detailed. Examining personnel showed great enthusiasm for the motorcycle training program, especially the hands-on training phase (actual operation of the machine). The content of this six-hour course of instruction has now been

California Dept. of Motor Vehicles, Div. of Field Office
Operation
1974 ; 77p

Supported by the National Hwy. Traffic Safety Administration
under Traffic Safety Proj. Agreement 057405.
Availability: Corporate author

HS-017 460

ACCIDENT FACTS, 1975 EDITION

A detailed analysis of accidents, with emphasis on the 105,000 accidental deaths and 11,000,000 disabling injuries in 1974, is presented. The following types of accidents are considered: all accidents (costs, causes of deaths, and trends in death rates by city, state, age and causes); work accidents, 1974 (by industry, death rates and trends, time lost, accident costs, effect of safety programs, nature and agency of injury, belt injury records in industry, and industrial safety awards); motor vehicle accidents, 1974 (principal classes of deaths, trends in death rates, causes of deaths, turnpike accidents, accidents by place and type of road and by vehicle movement, pedalcycle accidents, bad driving, recreational vehicle accidents, death rates by day and night, effects of alcohol, use of safety belts, and the energy crisis, accidents by driver age and sex, and pedestrian accidents); public accidents, 1974 (boating, public transportation, civil aviation, fireworks, railway-grade crossing, railroad, and firearm accidents); home accidents, 1974 (trends in home accident death rates, falls, fires, poisoning, suffocations, and firearms); farm accidents, 1974 (deaths in agriculture, types of accidents, tractor fatality rates, property losses in farm fires, 1952-1972, and farm machinery accidents on public roads); and school-college accidents, 1974 (school accidents by grade, sex, location and type, and school bus accidents by type and state).

National Safety Council, 425 N. Michigan Ave., Chicago, Ill.
60611
1975 ; 99p refs
Availability: Corporate author, \$2.80, Stock number 021.55

HS-017 461

REAR-IMPACTED VEHICLE COLLISIONS: FREQUENCIES AND CASUALTY PATTERNS. FINAL REPORT

Collision configurations and injuries were studied in accident data files maintained at the Highway Safety Research Institute, with particular emphasis on rear-end crashes and occupant injuries in rear-damaged cars. Police-reported data and in-depth, multidisciplinary accident investigation team data were used. Relative frequency and severity of rear-end crashes could be examined as well as such elements as seat separation, injury-type, and vehicle damage severity. It was found that: rear-impacted vehicles constitute about 20% (2,180,000 vehicles annually) of all damaged vehicles in police-reported accidents; in 91% of such accidents, there were no injuries, in 6.8% there were minor injuries, moderate injuries in 1.7%, severe injuries in 0.4%, and fatal injuries in 0.06% (about 1,200 fatalities annually); the number of whiplash injuries in rear impacts is about 1.25 million annually; and the frequency or severity of injuries in rear impacts is not greatly affected by seat belt usage. It was also found that: head restraints have little effect on the frequency or severity of neck injuries; the more severe the crash the more likely it is that seats will

crash the more likely it is that seatback deflection will occur; and the best current means of fully assessing the role of head restraints and other seating components are experimental crash tests and controlled field studies.

by James O'Day; Lyle D. Filkins; Charles P. Compton;
Thomas E. Lawson
University of Michigan, Hwy. Safety Res. Inst., Ann Arbor,
Mich. 48105
Rept. No. UM-HSRI-SA-75-2 ; 1975 ; 121p 13refs
Rept. for Nov 74-Jul 75. Sponsored by the Motor Vehicle
Manufacturers Assoc.
Availability: Corporate author

HS-017 462

FULL SCALE CRASH TESTS OF A TIRE-SAND INERTIA BARRIER. INTERIM REPORT

The results are reported of four full-scale crash tests conducted on inertia barriers using scrap tires as containers for the sand mass. The first barrier utilized additional tires with empty beverage cans in the annular space and banded together for a support base. The bases of the scrap tires collected under the front of the impacting vehicle (a 4290 pound 1967 Dodge Monaco at 64 mph) and caused it to ramp upward. The second scrap tire-sand barrier utilized a 14 gage welded wire cage to support the modules. The ramping of the vehicle was stopped smoothly. In the third and fourth tests (a 1968 Chevrolet weighing 4000 pounds with a 165 pound anthropomorphic dummy impacting at 43.1 mph) the supports were fabricated from used 55 gallon paint drums. When the chimes and tops and bottoms were removed and a series of vertical cuts made in the drum, the barrier performed satisfactorily. There was a slight tendency toward vertical ramping, but the vehicle was stopped smoothly. Documentary and high speed (200 frames per second) filming were used for recording the impacts. Accelerometer, time displacement data, and a table of events are appended.

by E. L. Marquis; T. J. Hirsch
Texas Transportation Inst., Texas A and M Univ., College
Station, Tex. 77843
Rept. No. RR-146-12 ; 1975 ; 93p 12refs
Rept. for Sep 1968-Mar 1975. In cooperation with the Federal
Hwy. Administration under Res. Study 2-10-68-146, "Studies
of Field Adaptation of Impact Attenuation Systems."
Availability: NTIS

HS-017 463

EFFECTS OF THE ENERGY CRISIS AND 55 MPH SPEED LIMIT IN MICHIGAN. FINAL REPORT

Findings derived from an analysis of Michigan traffic accident data and related data for the periods before, during, and after the peak energy crisis months (January-May) of 1974 are presented. The effects of the 55 mph speed limits imposed are identified. A computer program was developed providing an excellent means for identifying those elements in the accident data which best explain the differences between the periods before and after the energy crisis. It was found that: drivers aged 20-24 and 35-64 showed a reduction of 42.8% in fatal accident involvement; drivers under 20, 25-34, and older than 64 showed a 12.7% reduction; and fatalities on non-limited access U.S. and other state highways showed a reduction of 45.9%. It is concluded that: the 7% reduction in driver exposure due to

in fatal vehicle involvements during the first half of 1974; the 1974 reduction in speeds (<10 mph on Interstates, -5 mph on other U.S. and state trunklines, and -3 mph on county and local roads) reduced crash severity resulting in fewer fatalities; reduced speeds and fatalities during the second half of 1974, despite a return to normal traffic patterns, demonstrates the effectiveness of the 55 mph speed limit; and due to the 41% reduction in fatal involvements on non-interstate quality highways with only a 5 mph decrease in speeds, speed limits even lower than 55 mph on these roads would lead to less fatalities if strictly enforced. It is also concluded that: due to the small (20%) reduction in fatal involvements on Interstate-quality highways with the large (10 mph) decrease in speeds, there may be a net gain in lives saved if speeds there are allowed to rise slightly and enforcement is concentrated elsewhere; and the sudden jump in the fatality rate of 17-19 year old drivers (50% in the last half of 1974) together with their disproportionate share of speeding violations during the energy crisis shows the need for improving driver behavior within this age groups.

by James O'Day; Daniel J. Minahan; Dan H. Golomb
University of Michigan, Hwy. Safety Res. Inst., Huron Pkwy.
and Baxter Rd., Ann Arbor, Mich. 48105
Contract 013454
Rept. No. UM-HSRI-SA-75-9; 1975; 62p
Sponsored by the Michigan Office of Hwy. Safety Planning
and in cooperation with the National Hwy. Traffic Safety
Administration. On technical rept. title page: "Study on the
Effects of the Energy Crisis and 55 MPH Speed Limit in
Michigan."
Availability: Corporate author

HS-017 464

DRIVER RESPONSE TO THE 55 MPH MAXIMUM SPEED LIMIT AND THE VARIATIONAL CHARACTERISTICS OF SPOT SPEEDS

Spot speed studies were carried out on a four lane suburban freeway during the time period November 8, 1973 through November 7, 1974, when speeds were subject to influences due to the imposition of voluntary and statutory reduction of the maximum speed limits, introduced to reduce highway fuel usage. Speeds of individual vehicles were recorded, using a radar speed meter, in 15 minute intervals under light flow conditions in good weather on a total of 46 days. The mean speed of cars dropped 2.9 mph during the initial observations, and further dropped 2.8 mph after enforcement of the statutory speed limit. A multiple classification analysis was applied to the observed 15 minute mean speeds in order to determine the effect on the observed speeds of factors such as the time of day, day of week, traffic flow and truck composition. None of these factors was found to contribute significantly to the variance of the 15 minute mean speeds, although an effect due to the different observers was found. After removing the systematic effects, the variance of the 15 minute means with respect to the daily average speed was found to be significantly greater than would be expected from sampling errors if all the individual speeds in a 15 minute observation interval were drawn from the same distribution. The variance of the daily mean speeds with respect to the average for a period with stationary 15 minute mean speeds was also great, indicating that the mean speed of a 15 minute observation is statistically distributed, but stochastically stationary within periods of unchanged conditions.

by Tenny N. Lam; Paul Wasielewski
General Motors Corp., Res. Labs., Warren, Mich.
Rept. No. GMR-1711; 1974; 27p 5refs
Availability: Corporate author

HS-017 465

SPECIALIZED ILLUMINATION SYSTEMS FOR PEDESTRIAN CROSSWALKS

A state-of-the-art review and evaluation of the effectiveness of specialized illumination systems for pedestrian crosswalks are described. Available literatures was searched and contracts were made with city and state lighting and traffic officials, lighting equipment manufacturers, and visibility specialists. Extensive specialized systems in: Detroit, Michigan; Las Vegas, Nevada; Toronto, Canada; Winnipeg, Canada; Copenhagen, Denmark; Hanover, Germany; and Switzerland are identified and discussed. The effectiveness of these systems is examined. Both Toronto and Winnipeg, with similar systems and almost identical driver-pedestrian regulations, have shown a decrease in pedestrian accidents at illuminated crosswalks and a decrease in both pedestrian and driver delay at these locations, compared with locations with traffic signals or pedestrian-actuated signals. In Europe, most notably in Switzerland, Hanover, and Copenhagen, there has been a significant reduction in nighttime pedestrian accidents at specially illuminated crosswalks. Darkness/daylight accident risk ratios have improved and night wet-weather accident have decreased even more than all nighttime accidents.

by Michael S. Janoff; James W. Charles; Mark Freedman
Publ: Lighting Design and Application v5 n4 p43-8 (Apr 1975)
1975; 11refs

Sponsored by the Federal Hwy. Administration.
Availability: See publication

HS-017 466

VISIBILITY STUDY FOR LONG VEHICULAR TUNNELS

A method for the assessment of visibility requirements and lighting design in long vehicular tunnels is described. Observations and measurements were made at numerous North American and European tunnels. The acceptable ratio between the outdoor ambient luminance and that within the tunnel threshold zone, a point of controversy, is discussed. It is difficult to apply generalized rules to tunnel lighting design. Visibility requirements at the tunnel entrance are determined by the orientation and geometrics of the structure, the alignment of approaches, materials used for pavement and portal facing, traffic speed, traffic volume, relative location in the road system (rural, urban, flat, or mountainous terrain) and the desired level of service. Tunnel interior illumination consists of several systems: emergency lighting consisting of a separate power source; luminaires and lamps for night lighting (lamp sizes may have to be reduced from daytime lamp sizes to achieve better uniformity at low levels of illumination); daytime illumination (fed from separate circuits by same power source as night illumination); and the supplementary illumination at the entrance, and sometimes at the exit, (most difficult to assess and design). It is concluded that the variation in tunnel lighting codes can be explained by the wide differences in visibility conditions at different geographic locations.

lighting.

by A. Keltvirtis
Publ: Journal of IES v4 n2 p120-8 (Jan 1975)
1975 ; 8refs
Presented at the Annual IES Conference, New Orleans, La.,
14-18 Jul 1974.
Availability: See publication

HS-017 467

EUROPEAN APPROACH TO THE LUMINANCE ASPECT OF ROADWAY LIGHTING

A luminance method of roadway lighting, becoming increasingly popular in European countries, is described. The general characteristics of the open air test road at Eindhoven, Netherlands are discussed. The need for uniformity in road surface luminance, the effects of glare, and recommended lighting in Europe are considered. The various calculations involved in determining the surface luminance of a road (of average luminance, overall uniformity, lengthwise uniformity, and glare mark) are also mentioned. Field measurements of road luminance, utilizing a specially developed portable luminance meter and an instrumented field measuring vehicle (light-van) at the Eindhoven test road, are also described.

by D. Fischer
Publ: Journal of IES v4 n2 p111-9 (Jan 1975)
1975 ; 5refs
Presented at the Annual IES Conference, New Orleans, La.,
14-18 Jul 1974.
Availability: See publication

HS-017 468

ROADWAY SIGN ILLUMINATION

Guidelines for the illumination of roadway signs (so that the message will appear the same--night or day) are recommended. The following elements of roadway sign illumination are discussed: light sources for illuminated signs, color rendition of the light source, sign color standards, and lamp source selection (from the high desirability of fluorescent lamps to the low desirability of sodium low pressure lamps). External illumination of signs is specifically considered: ambient luminance; luminance of externally illuminated signs; uniformity; and location of the luminaire (top mounted, bottom mounted, and ground or remote located sources).

Illuminating Engineering Society, Roadway Sign Lighting Subcommittee
Publ: Journal of IES v4 n1 p78-81 (Oct 1974)
Availability: See publication

HS-017 469

A STUDY OF THE EFFECTS OF THE 55-MPH SPEED LIMIT

A study was undertaken to determine the effects of the 55 mph speed limit on fatal accident reduction in Colorado. Fatal accidents for urban and rural roadways, and for speed zones of 55 mph and zones less than 55 mph are studied. It was

speed zones by 11%. There was also a slight decrease in the average speed of vehicles involved in fatal accidents in these zones. The reduction in statewide fatal accidents appears to have taken place within the areas where speed limits were reduced, although changes in the number of fatal accidents by highway system tend to disallow assignment of the entire reduction to either rural or urban areas or to a particular highway system. It also appears that the reduction in travel has had some impact on the number of fatal accidents and there is evidence to support the assignment of a portion of the decrease to the Safety Improvement Program. The decrease in the number of total accidents is probably the result of the same combination of factors. Investigations of other variables involved in fatal accidents such as alcohol, light conditions, driver age, and urban/rural distribution have shown no significant changes or alterations in trend.

Colorado State Dept. of Hwys., Staff Traffic and Traffic Safety Div.
Rept. No. File-813.51 ; 1974 ; 8p
Availability: Corporate author

HS-017 470

THE PERCEPTION OF MANOEUVRES [MANEUVERS] OF MOVING VEHICLES. PROGRESS REPORT NO. 6. IMPLICATIONS OF PSYCHOPHYSICAL THRESHOLD MEASUREMENT FOR THE NIGHT DRIVING SITUATION. FINAL REPORT

The results of five studies of the psychophysics of night driving are summarized, specifically, tests of a driver's judgment of the distal behavior of a lead car on the basis of proximal changes in its taillight configuration. A generalized equation is derived which expresses threshold speed in depth for relative movement as a function of observation distance and observation duration. Calculations are then made to yield values of two important temporal parameters in car following (time until collision, and free time). It is shown that there are circumstances in which these parameters take values which are too short for the driver to escape a collision after he has detected that he is closing on a lead vehicle. Suggestions to improve the car following situation, in human factor terms, are presented. Methods of testing car following theories are also suggested.

by W. H. Janssen
Institute for Perception RVO-TNO, Postbus 23, Kampweg 5, Soesterberg, Netherlands
Rept. No. IZF-1974-C12; PR-6 ; 1974 ; 24p 17refs
Sponsored by the Inst. for Road Safety. Includes Dutch summary. See also PR-1 (HS-017 689); PR-2 (HS-017 690); PR-3 (HS-017 691); PR-4 (HS-017 692); and PR-5 (HS-017 693).
Availability: Corporate author

HS-017 471

COMPENDIUM OF PEDESTRIAN-BICYCLE SAFETY PROGRAMS

Literature is reviewed for ways of improving pedestrian and bicycle safety and a compendium of possible pedestrian and bicycle accident countermeasures, an abstract of each research item used, a one-page formatted description of each accident countermeasure, and a bibliography are presented. Recom-

mended types of pedestrian accident countermeasures are discussed: the separation of pedestrians from other traffic; education; reflective materials; engineering; crossing aids; removal of visual hazards; enforcement; alcohol countermeasures; reduction of speed limits in school areas; and audible reverse signals. The following types of more or less often recommended bicycle accident countermeasures are considered: separation of bicycle traffic; education; reflective materials; licensing; bicycle size, shape, and structure determinants; training; and safe areas for biking. High-rise bicycles are also critically discussed.

National Hwy. Traffic Safety Administration, Driver and Pedestrian Education Div.
1974?; 141p 41refs
Availability: Reference copy only

HS-017 472

INTERACTIONS OF OCCUPANT AGE, VEHICLE WEIGHT, AND THE PROBABILITY OF DYING IN A TWO-VEHICLE CRASH

Since occupant age has an effect on the likelihood of injury or fatality, and since it also varies strongly with car size, this study is intended to determine the relationships in a set of mass accident data while controlling for occupant age. The data set chosen for analysis was large enough to use the probability of a fatality as a dependent variable. Two specific models were developed. The first assumes that occupant age is independent of the effect of the weight of each vehicle in a two-vehicle crash, and of the interaction between the two weights. The probability of fatality is calculated as a function of age for the entire population. Subtracting out the effect of age makes it possible to compare the probabilities of fatality for different combinations of car weights in two car collisions. The second model assumes that occupant age can be interrelated with one's own vehicle weight, but that the effect of the other vehicle's weight is independent of the first two factors. In this model, probability of fatality is computed for each category of one's own car weight. By subtracting out the effect of occupant age and own car weight, it is possible to compare the probabilities of fatality for different categories of the other car's weight. A third model is proposed but not developed because of the size of the data set available. From the first model it is concluded that the probability of fatality is quadratic with age--probability of fatality increasing faster as one gets older. From the second, it is concluded that the probability of fatality as a function of age increases more rapidly for the occupant of a small car. Of the three kinds of two car interactions--small-small, small-large, and large-large, the first model indicates that the occupants of a small car in collision with a large car have the highest fatality probability. Occupants of a large car striking a small one have the lowest fatality probability; and the other two kinds of collision, small-small and large-large, have nearly equal fatality probabilities. The second model indicates that the small-small and large-large effects are a function of occupant age, such that younger persons are somewhat better off in a small-small collision than in a large-large, and older persons are worse off. Therefore, young persons would be less likely to die and older persons more likely to die in a world of small cars.

by Fred Preston
Publ: HIT Lab Reports v5 n12 p1-8 (Aug 1975)
1975; 12p 3refs
Availability: See publication

HS-017 473

TRAFFIC ACCIDENT FACTS, 1974 [FLORIDA]. AN ILLUSTRATED ANALYSIS OF ACCIDENT RECORDS

An illustrated analysis of accident records for Florida is presented in the 1974 Traffic Accident Facts. In addition to an annual summary, facts are presented for: contributing causes of statewide, urban and rural accidents; accidents and fatalities by month; age distribution; sex and residence; estimated property damage and economic losses; Florida traffic trends and statistics; traffic fatality map; traffic deaths by county; traffic accidents during the holidays; statewide condition of drivers and pedestrians; pedestrian deaths and injuries by age and sex; pedestrian actions; and state, county, and city maintained roads.

Florida Dept. of Hwy. Safety and Motor Vehicles, Accident Records Sec.
1975 ; 32p
Availability: Florida Dept. of Hwy. Safety and Motor Vehicles, Div. of Florida Hwy. Patrol

HS-017 474

DE LOREAN REPORT TO FEDERAL ENERGY ADMINISTRATION SAYS FUEL SAVING CARS NEED AIR BAGS [NEWS RELEASE]

A study emphasizing the need for air bags in current and future fuel-saving smaller cars is reported. The following conclusions are stressed: occupants are 38% more likely to be injured and 75% more likely to be killed in small cars versus large cars without passive restraints; if front seat air bags as standard equipment are delayed three years, the societal cost will be \$18.6 billion in injuries and fatalities; manufacturers should share some of the price savings of smaller cars with purchasers by installing front seat air bags; air bags could save 70,000 lives and prevent 1,750,000 disabling injuries in the next ten years; and if air bags were installed as standard equipment, they would cost no more than \$111.50 additional for full size six passenger cars. It is also concluded that: seat belt usage is so low that the benefits are far below those predicted for front seat air bag-lap belt systems; and insurance policyholder savings alone should exceed the cost of the air bag system.

Allstate Insurance Co.
1975 ; 6p
Availability: Reference copy only

HS-017 475

AUTOMOTIVE OCCUPANT PROTECTIVE SAFETY AIR CUSHION %AIR BAG% EXPENDITURE/BENEFIT STUDY [APPENDIX I. COMPUTER RUN SUMMARY]

Comparisons of the economics of the lap/shoulder belt system at 26% usage with the air cushion restraint system and lap belts indicate that equality of payoff would require lap/shoulder belt usage to be over 90% in the driver position, and over 100% in the right front passenger position, levels which are considered to be clearly unobtainable. A Minicair benefit/cost model provides a means of assessing the economics of proposed crashworthiness countermeasures whenever valid estimates of cost, effectiveness and usages

available. In the context of comparison for economic and effectiveness performance, the model produced the following results: belt usage is inadequate to allow equal benefits of the air cushion/lap belt system; economically, lap belt systems show low usage, and must reach 30% for returns to equal the investment; driver position, because of occupancy will allow for about 60% of all societal losses during 1975-85, making the installation of passive air cushion systems capable of 30 miles per hour protection an economic imperative; and insurance company estimates of total premium savings resulting from health, accident, life and auto insurance discount with air cushion use will total \$2 billion for the steady-state condition with all cars equipped; enough to completely pay for the cost of air cushions at current prices. The analysis speaks clearly on one point: the cost of delay is and will be socially intolerable, and implementation of 30 mile per hour frontal air cushion systems for driver and right front passengers must proceed quickly. Making lighter cars to meet the energy goals also allows for a lighter, cheaper, more fuel economical, and, when equipped with air cushions, a more safe system.

John Z. De Lorean Corp., Bloomfield Hills, Mich.
1975 ; 46p 8refs
Prepared for the Allstate Insurance Co. Subcontracted to Minicars, Inc. and Brigham Young Univ. (Dr. Charles Warner).
Availability: Reference copy only

HS-017 476

AUTOMOTIVE OCCUPANT PROTECTIVE SAFETY AIR CUSHION [AIR BAG] EXPENDITURE/BENEFIT STUDY

An evaluation of the total benefits and costs associated with various restraint systems (lap belt, three-point lap torso system, and the air cushion restraint system or ACRS with or without lap belts) likely to be widely installed in the period 1975-1985 is presented using an accident projection model. The following areas are examined: passenger car population trends (weight class shares of total industry, projected automotive sales by weight class, auto survival factors, and passenger cars in operation); injury and fatality exposure (injury rate as a function of vehicle mass, injury distribution by accident modes, and distribution of injuries by seat position); societal costs (average injury loss and fatality loss); the effectiveness of restraints (restraints' effectiveness comparisons, and overall restraint system effectiveness); and restraint usage rates and air cushion readiness (projected restraint system usage). Also considered are: restraint system costs (for full size six passenger cars and four passenger cars); the effects of delayed air cushion implementation on annual fatalities; and mandatory belt use laws (air cushions versus mandatory belt use laws). It is concluded that: even mandatory belt usage appears inadequate to allow benefits equal to those predicted for air cushion/lap belt systems; lap belt usage must reach 30% for returns to equal investment; insurance cost savings (\$2 billion for the steady state condition with all cars equipped with the ACRS) would completely pay for the systems; and without the ACRS, the fatality rate will increase 35% in the next decade with the greater use of fuel-saving smaller cars.

John Z. De Lorean Corp., Bloomfield Hills, Mich.
1975 ; 229p 12refs
Prepared for the Allstate Insurance Co. Subcontracted to Minicars, Inc. and Brigham Young Univ. (Dr. Charles Warner).
Availability: Reference copy only

THE EFFECTS OF AUTOMOBILE SAFETY REGULATION

A general discussion of the effects of automobile safety regulation is presented. The background of the major safety standards and design changes in automobiles (seat belts, shoulder harnesses, energy-absorbing steering column, penetration-resistant windshield, dual braking system, and padded instrument panel) is sketched. The following areas are discussed: the rationale for the direction of safety regulation; the determinants of automobile accidents (alcohol, youth, and vehicle speed); and estimates of the determinants of accident rates before and after regulation and the effects of safety devices (on death rates, injury and property damage, and driver risk taking) for both time-series and cross-section data. It is concluded that: the offsetting effects of nonregulatory demand for safety and driver response to safety devices are virtually complete, so that regulation has not decreased highway deaths; and time-series data imply some saving of automobile occupants' lives at the expense of more pedestrian deaths and more nonfatal accidents, a pattern consistent with optimal driver response to regulation.

by Sam Peltzman
Publ: Journal of Political Economy v83 n4 p677-725 (1975)
1975 ; 27refs
Availability: See publication

HS-017 478

MOTOR CARRIER ACCIDENT INVESTIGATION. WARE OIL AND SUPPLY CO., INC. ACCIDENT-- MARCH 1, 1975--PERRY, FLORIDA

A motor carrier accident investigation for an accident on U.S. 19 in Perry, Florida, occurring between a tractor cargo-tank trailer, and a straight truck, occupied by 12 members of a local fraternity, is presented. The tank-truck overtook and collided with the rear of the straight truck and resulted in 4 fatalities and 7 injuries. The slow moving straight truck, it was judged, was impeding the normal flow of traffic and due to its high mounted spotlights aimed toward the rear illuminating the roadway, presented a hazard to motorists confused by the light. In addition, the tank-truck driver was suffering from diabetes, and was physically unqualified by reason of visual deficiency, to drive. It is questionable whether a more efficient braking system would have changed the outcome.

Federal Hwy. Administration, Bureau of Motor Carrier Safety,
Washington, D.C. 20590
Rept. No. 75-1 ; 1975 ; 14p
Availability: Corporate author

HS-017 479

ELECTRIC CARS

The results of a study of the possible introduction of electric cars in Australia are presented. The patterns of motor vehicle ownership and use in Australia are considered. The technical and operational features of electric cars are examined and the environmental and economic impacts of their widespread use are assessed. The performance characteristics of electric cars and their effects on atmospheric pollution, noise, energy resources and the economic substructure of transport are

treated in detail. Emphasis is placed on likely design parameters of battery cars which could have a significant market appeal. Actual performance of such cars is analyzed by modelling techniques. It is concluded that: despite limitations on range and performance, battery cars could be acceptable for some types of urban travel in their present state of development; the likelihood of public acceptance is small but this could be reversed by regulations, by significant technical improvements in battery cars, or by increased operating costs for conventional cars; and widespread use of electric cars would substantially reduce pollution and noise in urban areas without depriving the community of the convenience of private motor cars.

Department of Transport, Bureau of Transport Economics,
Canberra, Australia
1974 ; 209p
Availability: Corporate author

HS-017 480

ACCIDENT CHANGES UNDER ENERGY CRISIS. REPORT ON ACCIDENT REDUCTION VARIABLES

The methods employed to determine the magnitudes of and reasons for the unusual accident declines experienced as a result of the 1974 fuel shortage are examined. A method of determining the 1974 accident expectation is discussed. Also considered are: the impact of reduced travel; the impact of permanent daylight saving time; total accidents and variation from average traffic speed; total accidents and speed relationship; and the application order of each of the accident reduction variables. Five years of historical accident information for the combined months of January through March were analyzed and the following findings are offered: California Highway Patrol (CHP) fatalities decreased 36.9% from expectation for the first three months of 1974; vehicles miles of travel were down 11.4% for January-March; the total energy crisis speed decrease was 6 mph; and accident involvement decreased 5.2% in CHP jurisdiction. Provisional findings for the April through June period are also presented: monthly fatality drops of 30.6%, 21.7%, and 25.4% (for a combined 25.9%); April and May vehicle miles were only reduced 6.6%; and highway travel speed has been rising very gradually.

California Hwy. Patrol, Sacramento, Calif.
1974 ; 83p 5 refs
On cover: "A Study On Accident Changes Under Energy Crisis."
Availability: Corporate author

HS-017 481

INTERINDIVIDUAL DIFFERENCES IN MESOPIC NIGHT VISION ABILITY MEASURED BY THE MESOPTOMETER

The relation between different aspects of mesopic night vision ability, age, and refractive power is examined. A total of 233 men (most 20, 40, or 60 years of age who were examined at an eye clinic) were tested with a mesoptometer. None had pathological conditions and all had a visual acuity of at least 1.0 with or without glasses. Contrast sensitivity at two levels of background illumination, contrast sensitivity during glare (low beam headlights), glare recovery time (high beam

test object was presented three times in different orientation) at each contrast level. Night myopia was measured by having the subject judge the visibility of a line pattern observed through glasses of different dioptries. Recovery time was measured as the time to recover from 10 seconds of glare to the threshold level of contrast. All testing started after five minutes of dark adaptation and lasted about 15 minutes. It was found that the five tests measured only three independent abilities: contrast sensitivity, glare sensitivity and night myopia. It was also found that: mesopic night vision ability decreased with increasing age; moderate correlations existed between age and mesopic night vision ability; and refractive status or power was important for determining the strength of those correlations.

by Hans Marmolin; Ilmari Rendahl; Karolinska Sjukhuset
University of Uppsala, Dept. of Psychology, Box 227, 75104
Uppsala, Sweden
Rept. No. 177 ; 1975 ; 35p 7 refs
Supported by grants from the Delegation for Applied Medical
Defence Res., the Official Swedish Council for Road Safety
Res. and the foundation "Fylgias 80-ars fond."
Availability: Corporate author

HS-017 482

TRANSPORTATION PROGRAMMING PROCESS. PROCEEDINGS OF A CONFERENCE, ORLANDO, FLORIDA, 23-26 MARCH 1975.

The proceedings of a conference on transportation programming generally related to the following issues is reported: programming should be based on goals and objectives and not on fund structures; governmental roles in programming should be clearly delineated; programming should continue to emphasize the trend toward decentralization of decision making to the lowest feasible level of government; fiscal philosophy for transportation programs is moving away from modal trust funding and categorical grants; diverseness and disparateness are characteristic of a continuum in the planning, programming, and project-selection processes. Discussions included: of programming in perspective; the Federal, state, and local role in programming; resource and financial management; pricing and investment in transportation facilities; program development; decision making; and the evaluation of the transportation programming process.

National Res. Council, Transportation Res. Board,
Washington, D.C.
Rept. No. TRB-SR-157 ; 1975 ; 81p
Availability: TRB, \$3.40

HS-017 483

HIGHWAY METRICATION. VOL. 1. TASKS 1, 2, 3, AND APERCU. FINAL REPORT

Various problems likely to arise during the metrication of highway systems are identified and a detailed plan for research aimed at solving the conversion problems is prepared. The first step was to gather information on such topics as: metric units, metrication methods, conversion timetables, metrication of standards and specifications, metrications of highway materials and equipment, metric training of personnel, and the costs and benefits of highway metrication. The Department of Transportation, Washington, D.C.

construction of metric projects; the adaptation of the projects to public use; setting up public information programs; and evaluation of the public reaction. The program for research is discussed.

by D. G. Meacham; A. G. Bishara; S. Mitric; L. Besch, Jr.; J. O. Hurd; T. B. Culp; J. M. Golding; M. E. Smith
Ohio Dept. of Transportation, 25 South Front St., Columbus, Ohio 43215
Contract FH-11-8309
Rept. No. FHWA-RD-75-68; ODOT-3 : 1975 : 359p
In cooperation with Ohio State Univ. Vol. 2 is HS-017 484.
Availability: NTIS

HS-017 484

HIGHWAY METRICATION. VOL. 2. APPENDIXES. FINAL REPORT

A study was conducted to identify various problems likely to arise during the metrication of United States highway systems. Sources of information examined in the study are listed: libraries, computer searches and other metric projects; organizations; highway equipment manufacturers; highway material manufacturers; a letter from General Motors; and reference works. An annotated bibliography (short abstracts of the work included) of the information sources dealing with metrication and summaries of various interviews held with British agencies and others regarding metrication are provided. Also presented are a straight bibliography of all works found dealing directly with metrication and selected plan pages for a metric highway project by the Ohio Department of Transportation.

by D. G. Meacham; A. G. Bishara; S. Mitric; L. Besch, Jr.; J. O. Hurd; T. B. Culp; J. M. Golding; M. E. Smith
Ohio Dept. of Transportation, 25 South Front St., Columbus, Ohio 43215
Contract FH-11-8309
Rept. No. FHWA-RD-75-69; ODOT-3 : 1975 : 174p refs
Prepared in cooperation with Ohio State Univ. Vol. 1 is HS-017 483.
Availability: NTIS

HS-017 485

HIGH STRENGTH MATERIALS AND VEHICLE WEIGHT REDUCTION ANALYSIS

An analytical technique is presented for quantifying vehicle component weight interactions and specifying the resulting iterative weight reduction than can be achieved through high strength material substitution. A hypothetical, interactive weight model is employed to predict reduced component weight targets. The resulting weight savings on a full-size vehicle (4,280 pounds) is about 880 pounds. Finite element computer structural analysis is used to evaluate the structural implications of this high strength material substitution process. Two finite element models were constructed: one model representing a typical production vehicle of mild steel; the other representing a hypothetical, lightweight, high strength vehicle of high strength steel and aluminum. The finite element models were tested statically (a 6 1/2 g loading test, a 5 mph impact test, and a jacking test) and dynamically (a normal modes analysis on the body, and a frequency response analysis on the subassembly of the rear suspension, final drive, and body). It is indicated that the structural performance of a lightweight, high strength vehicle could equal or surpass that of a current production vehicle constructed from mild steel.

by D. G. Adams; J. A. DiCello; C. Hoppe; A. S. Kasper; A. N. Keisoglou; W. W. McVinnie
Chrysler Corp., Engineering Office
Rept. No. SAE-750221 : 1975 : 12p 8refs
Presented at the Automotive Engineering Congress and Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 486

DEVELOPMENT OF LIGHTWEIGHT DOOR INTRUSION BEAMS UTILIZING AN ULTRA HIGH STRENGTH STEEL

The development of door intrusion beams fabricated from a low carbon, ultra high strength steel (Martinsite) is detailed. These beams meet all federal occupant protection requirements while adding only 15-20 pounds per vehicle. Door beam section analysis and door beam section selection are discussed and a general description of Martinsite steel is provided. The door beam fabrication process including current door beam testing methods (vehicle to vehicle crash, Federal standard door intrusion test, door fixture test, and static simple beam bending) is also discussed. The Martinsite door beam is shown to develop peak and average loads equivalent to those obtained from the standard production material door beams while weighing about half as much.

by T. E. Fine; S. Dinda
Inland Steel Co.; Chrysler Corp.
Rept. No. SAE-750222 : 1975 : 11p 15refs
Presented at the Automotive Engineering Congress and Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 487

A LIGHT DUTY DIESEL FOR AMERICA?

A study carried out to determine the feasibility of the diesel as a light duty power plant for American use meeting existing and proposed emissions targets is described. The target vehicle considered was essentially a compact sedan with standard performance capabilities. Two emission targets for hydrocarbons, carbon monoxide, and nitric oxides were determined. The study was divided into parts: a literature survey of all existing light duty diesel and pertinent heavy duty literature; brief design studies to cover all potentially viable diesel power plants (V-8 gasoline engine, in-line 6-cylinder gasoline engine, naturally aspirated V-8 4-stroke indirect injection diesel engine, turbo-charged 6 cylinder 4-stroke indirect and direct injection diesel engines, compressed 6-cylinder 4-stroke indirect and direct injection diesel engines, loop-scavenged 6-cylinder 2-stroke indirect injection diesel engine, uniflow 6-cylinder 2-stroke direct injection diesel engine, compound 4-cylinder 4-stroke direct injection diesel engine, and 2-stage 2-bank rotary diesel engine); and a rating methodology devised to allow a numerical comparison of all the power plants to be made. It is concluded that: it is possible to build a diesel powered passenger car meeting the same acceleration, general performance, and emissions standards as comparable gasoline cars; the vehicle would be less than one decibel noisier than a gasoline vehicle and would emit little if any visible smoke; the engine would be of similar size to an equivalent V-8 gasoline engine and weigh only 150 pounds more; and the vehicle can consume half the fuel of the equivalent gasoline vehicle. More work is needed to determine the ultimate potential of this engine.

by M. L. Monaghan; J. J. McFadden
Ricardo and Co. Engineers Ltd., England; Environmental
Protection Agency
Rept. No. SAE-750330 ; 1975 ; 12p 2refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 488

THE LIGHT DUTY DIESEL ENGINE FOR PRIVATE TRANSPORTATION

Benefits which would result from the use of small high-speed diesel engines (in terms of fuel economy and exhaust emissions) when applied to American type light-duty vehicles are considered. The advantages and disadvantages of diesel engines are discussed with respect to: fuel economy, engine weight and package size, prime cost, exhaust emissions (visible and invisible), noise, cold starting, roughness, and driveability. Specifications are proposed for two engines of 100 and 150 horsepower (hp) which should satisfy the requirements of private cars, taxis, light delivery vans, and recreational vehicles. Power, engine speed, combustion system, and piston speed are considered. More comparisons between diesel and gasoline engines are made in terms of: bore, stroke, and cylinder number; maximum cylinder pressure; thermal loading; fuel injection equipment; cylinder head; cylinder block; valve gear; and timing drive. It is concluded that: the economic advantages to the operators of taxis and light delivery vehicles in urban use will be equal to or greater than that in Europe; the diesel engine car will be able to meet interim emission limits without the expense of catalyst or other hang-on devices; the diesel can replace the gasoline engine size for size in both 100 hp in-line 6 and 150 hp V8 configurations without the need for turbocharging; noise, vibration, and odor levels and driveability with manual transmission would be quite acceptable; the manufacture of diesels for the American market is only inhibited by the threat of the lower 0.4 gallon/mile nitric oxide emission limit; and diesel engines could use improvement in starting, fuel injection equipment, and noise and heat rejection.

by H. W. Barnes-Moss; W. M. Scott
Ricardo and Co. Engineers 1927 Ltd., England
Rept. No. SAE-750331 ; 1975 ; 19p 8refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 489

ANALYSIS OF DRIVER CONTROL MOVEMENTS ON A LIMITED-ACCESS DIVIDED HIGHWAY

An analysis is presented of basic control movements (steering wheel, acceleration pedal, and brake) obtained in about 5,500 miles of driving on a limited-access divided highway, using 14 volunteer subjects (10 men with an average age of 33 and 4 women with an average age of 35) who were told to drive as they normally would, exceeding the 60 mph speed limit if they wished. For the first two months of the project, an observer was present in the vehicle (a 1971 North American 4-door hardtop, equipped with automatic transmission, power steering, and power brakes). It is shown that the frequency and magnitude of steering wheel movements (reversals) are dependent upon vehicle speed and traffic density. The increase in

frequency of small magnitude reversals with increasing vehicle speed and/or traffic density reflects the greater task difficulty imposed upon the driver in these conditions. There is evidence that such data may be used as a means of identifying accident-prone drivers but they appear to be of little value in assessing the relative skill or experience of individual drivers.

by R. T. Sewell
National Res. Council Canada, National Aeronautical
Establishment, Ottawa, Canada
Rept. No. NAE-MS-136; NRC-14811 ; 1975 ; 41p 4refs
Includes French summary.
Availability: Corporate author

HS-017 490

ADD-ON BIKE SEATS FOR CHILDREN

The results of the evaluations of 24 add-on bike seats for children are reported. Front and rear-mounted seats were rated for: handling interference or noninterference; effectiveness of child foot guards, if present; quality of restraint straps, if present; adequacy of pedaling clearance; ease in walking the bike; and ease of pedaling.

Publ: Consumer Reports v40 n7 p421-4 (Jul 1975)
1975
Availability: See publication

HS-017 491

HIGHWAY ACCIDENT REPORT. GEORGE WOLLMAN MEATS, INC., TRUCK/AUTO/GREYHOUND BUS COLLISION AND FIRE, NEW JERSEY TURNPIKE, BORDENTOWN, NEW JERSEY, OCTOBER 19, 1973

At 8 pm. on October 19, 1973, a tractor-semitrailer traveling at 55 mph on dry pavement at night on the New Jersey Turnpike had a blow-out of its left front tire. The tractor veered and crashed through the median guardrail and the truck struck an oncoming automobile (Mustang) crushing it between the truck and an oncoming Greyhound bus. The automobile split in half, and the rear half, wedged into the front of the bus, caught fire. The truck ran off the road, through a guardrail, down a 50-foot embankment, and turned onto its right side. The truckdriver was not wearing an available seatbelt and he was ejected. The automobile driver and passenger, the bus driver, and six bus passengers died in the crash. The truckdriver and 10 bus passengers were injured. Property damage amounted to \$100,000. It was determined that the probable cause of the accident was the sudden deflation of the left front tire on the tractor causing the driver to lose control of the vehicle. The deflation resulted from a gross failure of the tire sidewall due to underinflation caused by an undetected nail puncture. Contributing to the fatalities and injuries was the inadequacy of the median guardrail to prevent the tractor-semitrailer from entering into the opposing lanes of traffic.

National Transportation Safety Board, Bureau of Surface
Transportation Safety, Washington, D. C. 20594
Rept. No. NTSB-HAR-75-3; SS-H-32 ; 1975 ; 31p
Includes Hwy. Safety Recommendations H-75-9-H-75-11
Availability: NTIS

TRAFFIC SIGNAL WARRANTS. A BIBLIOGRAPHY

As part of an evaluation of the adequacy of existing traffic signal warrants in meeting current needs for determining whether a traffic signal should be installed, an annotated bibliography of relevant literature pertaining to warrants is provided. A literature review, mostly of materials published since 1967, was conducted. The subject scope of the bibliography was limited to traffic signal warrants for isolated intersections. The bibliography is assembled in two parts: 152 entries covering the general subject area; and 29 entries including supplementary material on accident occurrence and costs. Entries are listed by author in alphabetical order. Tables classifying entries by subject are provided.

by G. F. King; J. L. Barker; J. W. Perry
Publ: Road Results Digest n78 (Aug 1975)

1975 ; 42p 181refs

Compiled as part of the final rept. from NCHRP Proj. 3-20, "Traffic Signal Warrants."

Availability: TRB

HS-017 493

CHILDREN AS PASSENGERS IN AUTOMOBILES: THE NEGLECTED MINORITY ON THE NATION'S HIGHWAYS

The problem of infants' and children's need for special seat restraints in automobiles is examined. Federal Motor Vehicle Safety Standard 213 (FMVSS 213) for child seating systems and its subsequent revision, the availability of effective devices, the position of car seat manufacturers, and the focus on child protection in scientific literature are discussed. Also considered are: the importance of using safety devices correctly, the performance rating of child restraints, in-hospital education of new parents, and pediatrician involvement. It is concluded that: it is essential for parents to keep abreast of advances in child seat development; in-hospital instruction of expectant and new parents is showing promising results; and there is an urgent need for pediatricians to become involved in this vital area of "preventive medicine."

by Annemarie Shelness; Seymour Charles

Publ: Pediatrics v56 n2 p271-84 (Aug 1975)

1975 ; 97refs

Availability: See publication; Executive Director, Physicians for Automotive Safety, 50 Union Ave., Irvington, N. J. 07111

\$1.50

HS-017 494

SERIOUS TRAUMA TO CAR OCCUPANTS WEARING SEAT BELTS

Some factors compromising the optimal performance of seat belts are discussed in detail and the nature and frequencies of serious injuries sustained by seat belt users are described. An accident sample including 82 cars with 108 front seat occupants wearing seat belts (three-point static, three-point automatic, and diagonal static belts) was analyzed. The automobiles are classified by impact type: front side, rear, rollover, complex, and under-run. Injuries are rated by the abbreviated injury scale. Compromising factors affecting seat belt performance in fatal and severe accidents included: intrusion, rollover in soft-top car, excessive load on belt due to rear load-

ing, fire, and incorrectly positioned belt. Belt failures due to excessive forward movement are determined: center stalk broke, belt broke, mounting failed, excessive slack in wearing, reel broke up, belt reeled out completely, and excessive reel out. The usage rates for belts in spring 1975 are determined and seat belt-induced injuries (chest, abdomen, and pelvis) are rated on an abbreviated injury scale. Some causes of belt-induced injuries are determined: belt worn slack, belt positioned incorrectly, and rear loading by other occupants. It is concluded that: for the restrained driver, face contact with the steering wheel is the most common cause of injury; intrusion into the passenger compartment is the most frequent compromising factor on belt performance; incorrectly positioned belts are a particular threat to the abdominal area; inertia reel belts are shown to allow more occupant movement than occurs with static belts; wear rates of standard equipment static and inertia reel belts do not appear to be significantly different; standards controlling the performance of inertia reel systems should be urgently considered; and the provision and use of rear seat belts are essential to protect the front occupants.

by G. M. MacKay; P. F. Gloyns; H. R. M. Hayes; D. K.

Griffiths; S. J. Rattenbury

University of Birmingham, Accident Res. Unit, Birmingham, England

Publ: HS-018 062, International Conference on Biomechanics of Serious Trauma (2nd), Amsterdam, Holland, 1975 p20-9

1975 ; 11p 11refs

Conference held in Birmingham, England, 9-11 Sep 1975.

Availability: In HS-018 062

HS-017 495

TIRE CORNERING PROPERTIES

A critical review is presented of tire test techniques, test equipment, data processing methods, and mathematical models for obtaining data and describing tire cornering properties. The applicability of this data for evaluation of vehicle directional response properties is examined and the influence of test and data processing methods on tire parameters used in model simulations is shown. Mathematical relationships between tire parameters and vehicle directional response parameters such as steering sensitivity are demonstrated. Fundamental differences between conditions prevailing in testing, hypothetical assumptions used in mathematical models, and actual tire operating conditions on a vehicle are discussed. The need for transient tire measurements and modeling for transient conditions is also shown.

by W. Bergman; H. R. Clemett

Publ: Tire Science and Technology v3 n3 p135-63 (Aug 1975)

1975 ; 57refs

Presented at the ASTM Com. F-9 on Tires, Symposium on Off-the-Road Tire Performance and Cornering Characteristics of On-Road Tires, Akron, Ohio, 13 Nov 1974.

Availability: See publication

HS-017 496

ESTABLISHMENT AND CALIBRATION OF A TREAD WEAR TEST COURSE

The process of designing and calibrating a test course for the evaluation of the tread life of passenger car tires is described. The method of design consisted of running specific radial, belted bias, and bias tires, called course monitoring tires, over

route and measuring the rate of wear on each construction. The course was then modified to increase or decrease the rates of wear until a desired result was obtained. Three convoys of six vehicles, all vehicles in a convoy having tires of the same construction (Mercury Comets with 15 inch and 13 inch wheel rims), and four convoys of six vehicles each (Chrysler Newports with 15 inch rims) were run for 8000 miles after break-in. Drivers and tires remained with the same vehicles and in the same order throughout the tests. The first group of test convoys used prototype course monitoring (PCMT) and other commercial tires to follow tread life evaluation. The second group tested used samples of course monitoring tires from specially purchased lots to measure the variability of tires within each lot. Radial tires were found to wear at a slower rate than other tires, and bias ply tires to wear at a faster rate. Tread life projected from data collected at the end of 6400 miles and 8000 miles was highly correlated. When projected tread lives were adjusted using the PCMTs, the two sets of results were almost identical. Tread wear rates did not change abruptly over short periods of time. It was also found that: tires run at different times over the same course wore at different rates; duplicate tires with different wear histories run at the same time wore at the same rates; and the belted bias tires had the greatest variability in tread wear.

by F. C. Brenner; Akira Kondo; F. W. Barton
Publ: Tire Science and Technology, v3 n3, p164-88 (Aug 1975)
1975 ; 9refs
Availability: See publication

HS-017 497

A NOTE ON HEAT GENERATION DUE TO SURFACE RUBBING

The question of heat generation by frictional rubbing is examined from the point of view of material elastic properties. Theory suggests and evidence is presented that low modulus materials tend to generate more internal heat during rubbing than high modulus materials of similar thermal properties. Two types of contact resistance when applied to two surfaces in rubbing contact are identified: a plane, interfacial phenomenon due to imperfect geometrical contact, the presence of contaminants and air gaps, and the usual impediments to perfect thermal conductivity; and a contact resistance caused by heat loss by hysteresis at a mean distance below the rubbing contact surface and associated with surface stresses set up by sliding or normal pressure, provided that they are fluctuating or variable.

by S. K. Clark
Publ: Tire Science and Technology, v3 n3 p189-95 (Aug 1975)
1975 ; 4refs
Availability: See publication

HS-017 498

TIRE VIBRATION STUDIES: THE STATE OF THE ART

General principles of mechanical vibration engineering are used to discuss the total tire vibration problem in terms of three necessary factors: an excitation force, a transmitter, and a receiver of the vibratory force. The present state of knowledge for each of these factors is discussed and an overall goal for reduction of vehicle vibration is formulated. Current experiments for investigating tire vibration transmissi-

bility are described and the results presented: the first used an electrohydraulic shaker; and the second used time average holography, in order to see tires, and investigated impact wave propagation in tires with double-pulsed laser holography. Results show that it is difficult to reduce tire transmissibility and to shift resonant frequencies; however, this may be accomplished by introducing small amounts of body ply crown angles in radial tires (0-20 degrees). Results of the impact wave propagation tests are beginning to reveal the true nature of what happens when a tire strikes a sharp bump.

by G. R. Potts; T. T. Csora
Publ: Tire Science and Technology, TSTCA v3 n3 p196-210 (Aug 1975)
1975 ; 44refs
Presented at the winter meeting of the Akron Rubber Group, Akron, Ohio, 25 Jan, 1974.
Availability: See publication

HS-017 499

A SURVEY OF MOTOR VEHICLE BURN ACCIDENTS IN CHILDREN: REPORT OF 45 CASES

The association of burns with motor vehicles was reviewed from the records of 1,532 children treated at a Texas hospital since 1966. Forty-five children were burned in or about motor vehicles. The most common causes were gasoline spillage in moving vehicle accidents, and small children playing with matches unattended in a stationary vehicle. Motor vehicle burn patients had more serious and larger burns than in the general burn population. Of the 34 children burned within the confined space of a motor vehicle, 94% suffered face and/or hand burns. There was a high incidence of respiratory problems. In the moving-motor vehicle fire accident group there were 13 major injuries seen in 17 patients. Of the total motor vehicle occupancy in 38 separate accidents, 19 people died and 66 were hospitalized.

by Barry G. King, Jr.; Sally Abston; E. Burke Evans
Publ: Journal of Trauma v15 n6 p490-3 (Jun 1975)
1975 ; 15refs
Availability: See publication; Barry G. King, Jr., M.D., U. S. Public Health Service Hosp., P.O. Box 3145, Seattle, Wash. 98114

HS-017 500

STYLE, PERSONALITY AND ACCIDENTS

The growth and use of the term "accident proneness" is discussed. The effect of style and personality on accident frequency is considered with emphasis on bad driving behavior. Numerous psychological studies are cited, giving a brief survey of the development of concepts. Several terms used in recent studies of accident causation are emphasized: two kinds of stylistic difference in handling a vehicle, the inert overactive continuum (caused by fatigue) and the phenomenon of dissociation (low degree of awareness of task at hand); and the notion of anticipatory tension which can produce the above stylistic differences.

by James Reason
Publ: New Society (England) v27 n594 p445-8 (21 Feb 1974)
1974
Availability: See publication

HS-017 501

A UNIQUE CONCEPT FOR AUTOMATICALLY CONTROLLING THE BRAKING ACTION OF WHEELED VEHICLES DURING MINIMUM DISTANCE STOPS

Test results of an automatic brake control system are outlined and its mode of operation is compared with that of an existing skid control system. The system provides automatic control of braking action such that hydraulic brake pressure is maintained at a near constant, optimum value during minimum distance stops. It consists of a wheel sensor unit mounted on the rear axle of a test vehicle and a brake pressure stabilization valve mounted in the brake line leading to the rear wheels. Mounted on a stand next to the driver was an oscilloscope recorder providing a time history of: brake fluid pressure in the front wheels and master cylinder; brake fluid pressure in the rear wheels; the deceleration rate of the vehicle; the linear velocity of the vehicle; the angular velocity of the rear wheel containing the sensor unit; and the opening and closing of the reed switch in the sensor unit. Stops were made at velocities ranging from 20 to 50 mph on wet and dry concrete and asphalt. Test data validated that the system automatically selects a value of pressure which produces a near maximum braking effort and then maintains this pressure essentially constantly throughout the remainder of the stop. It is concluded that system performance would have been improved had the test vehicle been equipped with disc rather than drum brakes. Observations made during the test program indicate that an acceptable four-wheel skid control system may only need sensors on the rear wheels.

by Donald E. Bartholme
National Aeronautics and Space Administration, Langley Res. Center, Hampton, Va. 23665
Rept. No. NASA-TM-X-72665; N75-23987; 1975; 33p 2refs
Availability: NTIS, \$3.25; STIF/NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, Md. 20740

HS-017 502

STATEMENT OF THE STATE OF ILLINOIS IN RESPONSE TO THE HIGHWAY SAFETY SANCTION HEARING, WASHINGTON, D.C., SEPTEMBER 30, 1975

The complete statement of the State of Illinois in response to the highway safety sanction hearings conducted in Washington, D.C. on September 30, 1975 is presented. Illinois was faced with cutoff of Federal safety funds because the compulsory motorcycle helmet wearing requirement of Federal Motor Vehicle Safety Standard 218 had not been complied with in that State. The Illinois position is summarized, the discretionary power of the Secretary of Transportation is questioned; and the threat of a Federal cutoff to Illinois' traffic safety program is expressed. Illinois' good traffic safety record and its substantial compliance with the motorcycle safety standard are emphasized. Also discussed are: Illinois' legal predicament (previous compulsory helmet law has already been declared unconstitutional); consideration of public opinion and personal liberty; untimely nature of the proceedings (considering the changes to the 1966 Highway Safety Act now being considered by Congress); and a supplemental motorcycle safety program proposed by the State. Excerpts and documents from relevant court trials, excerpts from the Illinois Motor Vehicle Code

pertaining to motorcycles, and a summary of a helmet use survey conducted in Illinois are appended.

by Karsten J. Vieg
Illinois Dept. of Transportation, Office of Transportation Safety
1975; 47p
Availability: Corporate author

HS-017 503

RIGHT-TURN-ON-RED: CURRENT PRACTICES AND STATE-OF-THE-ART. INTERIM REPORT

To determine past experiences with right-turn-on-a-circular-red traffic signal (RTOR), a literature review and a survey of state and city practices was conducted. A questionnaire was sent to all 50 states and it was determined that 24 states presently allow RTOR as a general rule, 22 states permit it with an authorizing sign and 4 states totally prohibit RTOR. The usage of the RTOR provision in those states where it is permitted by sign varies from 0.1% to 64% of all the state-controlled signalized intersections. City RTOR practices generally follow those of their respective states. A state-of-the-art summary contains information on accidents, delay, capacity, level of service, gap acceptance, and signing. The data collected to date indicates that RTOR does not significantly increase accidents but does reduce right-turn delay.

by H. W. McGee
Alan M. Voorhees and Associates, Inc., Westgate Res. Park, McLean, Va. 22101
Contract FH-11-8251
Rept. No. FHWA-RD-75-5; PB-239 916; 1974; 102p 30refs
Availability: NTIS

HS-017 504

SAFETY IN MASS TRANSIT: A CASE STUDY OF BUS ACCIDENTS IN WASHINGTON, D.C.

An analysis of 1971 District of Columbia (D.C.) police accident reports noting the involvement of a bus is presented to obtain an increased understanding of the variables involved in transit bus accidents. To give the research perspective and facilitate the development of a research design, the future role of transit buses in urban transportation and traffic safety was analyzed and a review of relevant traffic safety research and programs was conducted. Two data analyses were performed on each of the bus accident files: the frequency and percent distribution of possible values for each variable were computed; and cross tabulation of selected variables pertaining to the operating environment were made. The typical D.C. bus accident was found to be a collision between a bus and another motor vehicle, usually an automobile. The vehicle involved in bus accidents tended to be older than those involved in automobile accidents. It is in the area of injuries that transit buses have their greatest safety problems. Factors in the operating environment such as traffic congestion, intersection width, differences in maneuverability between vehicle types, and route design were found to have an important role in the frequency and severity of transit bus accidents. It is concluded that: because vehicle design is defined by the requirements of intracity bus service, improved bus safety requires a reduction of safety hazards in the operating environment in addition to vehicle design innovation. Recommendations for reducing safety hazards in the operating environment in addition to

vehicle design innovation. Recommendations for reducing safety hazards in the operating environment are made and an inexpensive safety program for implementing them in different metropolitan areas is proposed.

by John W. Shanley
Consortium of Universities, 1717 Massachusetts Ave., N.W.,
Washington, D.C. 20036
Rept. No. UMTA-DC-11-0003-74-3; PB-238 940 ; 1974 ; 147p
26refs
Availability: NTIS

HS-017 505

THE TRANSPORTATION INDUSTRY CONFERENCE ON INFLATION, LOS ANGELES, CALIFORNIA, SEPTEMBER 19-20, 1974

The proceedings of the Conference on Inflation, attended by 70 key representatives of transportation management, labor, and users are reported. The prepared statements of 39 of the participants are presented. Three major themes emerged from the conference: there was widespread recognition that transportation's major long-term contribution to fighting inflation is in achieving greater productivity; particular attention should be directed to ensuring that governmental regulation of transportation does not stand in the way of the goal of economic efficiency or fail reasonable cost-benefit tests; and the great interdependence between the energy sector and the transportation sector emphasizes the importance of energy conservation and lower energy prices as national goals in the overall fight against inflation.

Department of Transportation, Office of the Secretary
1974 ; 417p
Availability: Reference copy only

HS-017 506

STATEMENT BEFORE THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA) AT THE PUBLIC MEETING ON STANDARD NO. 208, OCCUPANT CRASH PROTECTION, HELD MAY 19, 1975

FMVSS 208, starting with the 1977 model year, requires new car restraint for the front seat passengers to be either fully passive or passive for the crash configurations most frequently producing serious and fatal injuries. The following topics are discussed: proper occupant restraint; the concept of passive versus active protection; the development of FMVSS's (208 in particular); options in meeting FMVSS 208's requirements; the effect of mass media campaigns on seat belt use; and the technology of passive systems.

by William Haddon, Jr.; Albert B. Kelley
Insurance Inst. for Hwy. Safety
1975 ; 27p 27refs
See also HS-017 507, Appendices A-C.
Availability: Corporate author

HS-017 507

RESTRAINT USE AND EFFECTIVENESS IN REAL- WORLD CRASHES; FEW CHILDREN PROTECTED

IN CARS; [AND] PAPERS RELEVANT TO FEDERAL MOTOR VEHICLE SAFETY

Estimates of restraint effectiveness in real-world crashes obtained by multiplying the effectiveness of the restraint question in particular crash modes times the proportion of crashes in which the restraints are used. Objective estimates based on a number of studies, are attempted. It is concluded that: belts protect occupants in crashes, but less so in front than other crashes; precise measures of belt effectiveness in the real world have not yet proved completely possible because of potential biases in reporting belt use; the majority of vehicle occupants will not be protected by restraints without passive protection; passive protection in form of air bags has proven equal and possibly superior to belts, when the latter are used; and the requirement that cars have passive restraints would result in 4 to 5 times as much protection against serious injury as belts. An observational survey of 8,893 children less than 10 years old in 5,000 cars at 14 amusement areas and shopping centers in Maryland, Massachusetts and Virginia is also reported. It was found that only 7% of the children were properly restrained; even with child seating devices were present, 79% were either adequately, unused, or not used correctly; and even when parents were properly restrained, more than 75% of their children were not.

by Leon S. Robertson
Insurance Inst. for Hwy. Safety, Washington, D.C.
1975 ; 29p 83refs
Appendices A-C to HS-017 506, Statement before the NHTSA Public Meeting on MVSS 208, "Occupant Crash Protection," held on 19 May 1975.
Availability: Corporate author

HS-017 508

AN EVALUATION OF DRIVER SIMULATORS FOR SAFETY TRAINING

An empirical evaluation of driving simulators is presented, including: an analysis of existing simulator equipment and programs; a determination of the research problems associated with an evaluation of simulator effectiveness; and a preliminary study of simulator (Aetna Drivotrainer, a programmed picture simulator) teaching effectiveness. Existing driver training programs appeared to give insufficient practice in emergency procedures such as special collision avoidance techniques, and certain driving habits such as maintenance of proper speed. The preliminary study was performed from August to November 1964. A twenty-hour driver safety education course was administered to 193 experienced drivers, about half receiving a program utilizing the Drivotrainer and half a program using conventional media. The two groups were essentially equal with respect to critical pre-training variables. A test was given following the completion of all classes consisting of: a written knowledge test; an opinion survey; a simulator test of driving habits; and a trainee report of driving behavior. Results showed the simulator group to be slightly superior in those knowledges and driving habits emphasized by the simulator program. The conventional group was superior on those knowledges concerned with the common lecture of the course. No differences were obtained on the opinion survey or behavior report. While the results were obtained solely on the Drivotrainer, they are believed to apply to programmed motion picture simulator of the same general character. It is concluded that: simulators do not appear superior as a means of influencing safety opinions; and driver

ment of simulators for improvement of driver safety is likely to require some modification of equipment and extensive revamping of program content and schedule.

by A. James McKnight; Harold G. Hunter
George Washington Univ., Human Resources Res.
Organization (HumRRO), 300 North Washington St.,
Alexandria, Va. 22314
Contract DA-44-188-ARO-2
Rept. No. AD-A012315; Exploratory-Study-20 ; 1965 ; 70p
24refs
Availability: NTIS

HS-017 509

FACTORS CONTRIBUTING TO THE REDUCTION OF MOTOR VEHICLE FATALITIES IN 1974

Two studies conducted to determine and evaluate the factors contributing to the reduction of motor vehicle fatalities in 1974 are reported. The first covered January through April 1974 and the second study covered May through August 1974. Factors examined included: speed reduction; changes in the amount and circumstances of travel; reduction in average occupancy; increased safety belt use; unknown factors; and factors tending to increase fatalities. It is concluded that: speed reduction accounted for nearly half the reduction in fatalities in the first four months of 1974 and slightly more than half in the second four months; and changes in the amount and circumstances of travel accounted for a third of the decline in the first four months but only an eighth of the decline in the second four months; average occupancy reduction caused a fatality reduction of 3% in the first four months and 2% in the second four months; and increased belt use resulted in a fatality reduction of 1% in the first four months and 2% in the second four months.

by Vincent L. Tofany
Publ: Journal of Safety Research v7 n3 p100-3 (Sep 1975)
1975
Adapted from a paper presented at the Fourth International Congress on Automotive Safety.
Availability: See publication

HS-017 510

DELAYED EFFECTS OF ACUTE ALCOHOLIC INTOXICATION ON PERFORMANCE WITH REFERENCE TO WORK SAFETY

An investigation was undertaken of the aftereffects of alcohol in a simulated industrial work situation. Nine male subjects were administered a series of tests that took place before, during, and after an evening of social drinking. The test periods were designated sober, peak intoxication, morning-after, and afternoon-after. Each subject participated in three test sessions over a 2-week period. The apparatus used in testing were an eye/hand coordination device simulating motions commonly required in industry, a task board requiring precise object positioning within a normal industrial reach area, and a lordosimeter used to test changes in spinal configuration during performance of a static load-holding task. Subjects were also given a questionnaire measuring subjective mood. Blood alcohol concentrations attained after ingestion of alcohol ranged from .065 to .175%. Delayed effects were observed up to 18 hours after ingestion. These included lengthened reaction time, poor motor performance, and decreased motor sensory skill, as well as inability to manipulate and position without tactile

and/or visual facilitation. Visual scanning was limited and postural configuration somewhat deteriorated. The psychological tests indicated post-alcohol effects on subjective mood. Some of these effects could create safety and health problems in a work situation.

by Robert C. Wolkenberg; Calman Gold; Erwin R. Tichauer
Publ: Journal of Safety Research v7 n3 p104-18 (Sep 1975)
1975 ; 34refs
Availability: See publication

HS-017 511

EVALUATION OF WHEEL BLOCKING FOR VEHICLES PARKED ON SLOPES

An analytical study of the equilibrium of a vehicle parked on a sloping roadway with one or more wheels blocked by a suitable object or the available curb is presented. Two models of a parked vehicle (a rigid vehicle, and one with Ackermann steering) are described, equilibrium conditions are formulated, and conclusions are drawn in both qualitative and quantitative terms. An assessment of the relative advantages and disadvantages of blocking lower and upper wheels, reveals that vehicle weight and block shape are unimportant, and leads to a description of various failure modes. The relationship between curb height and maximum safe roadway slope is explored, and it is shown that trucks present a greater safety hazard than do passenger automobiles.

by Dean L. Taylor; Thomas R. Kane
Publ: Journal of Safety Research v7 n3 p119-26 (Sep 1975)
1975
Availability: See publication

HS-017 512

DWI PROGRAMS: DOING WHAT'S IN OR DODGING WHAT'S INDICATED?

Driving while under the influence of alcohol (DWI) programs currently being implemented are analyzed and discussed. Drunken driver countermeasures generally fall into the categories of general deterrence (mandatory breath tests) and specific deterrence (educational programs for DWI drivers). Phoenix programs, currently in fashion and employing the latter approach to prevent recidivism, are considered. A problem with these programs is that they deal with the typical drunk driver, who is not necessarily representative of all drinking drivers. Those arrested for DWI may be caught because there are greater numbers of police in the areas where they live and do their drinking. Programs designed to prevent recidivism may not be effective because of the low probability of being arrested for DWI. It is concluded that, potentially, the best programs are those that combine low legal blood alcohol concentrations with vigorous and uniform enforcement.

by Paul C. Whitehead
Publ: Journal of Safety Research v7 n3 p127-34 (Sep 1975)
1975 ; 42refs
Adapted from a paper presented at the Joint Convention of the Canadian Foundation on Alcohol and Drug Dependence and the Alcohol and Drug Problem Assoc. of North America, Quebec City, Canada, Sep 1975.
Availability: See publication

ENERGY ECONOMICS OF AUTOMOTIVE POWER GENERATION

An attempt is made to demonstrate the importance of considering fuel production and utilization as inter-related components of a single process, the conversion of natural chemical energy into a usable form in an economic manner. Petroleum based fuels for automobile use are discussed in the following manner: change of the petroleum use pattern; reduction of power unit fuel sensitivity; improvement of power unit thermal efficiency; future trends in power plant selection and petroleum based fuel production; and optimization of automotive use of petroleum fuels. The following aspects of the automotive use of coal based fuels are considered: gasoline from coal; diesel fuels from coal; carbonization products; hydrogenated products from coal or the Bergius Process; hydrogenation of carbon monoxide; technical suitability of coal based fuels for automotive diesel engine use; future trends in power plant selection for coal based automotive transport; and optimization of automobile use of coal based fuels. The integrated process approach (using power generation as an example) is shown to result in appreciable reductions in the rate of consumption of crude oil. An examination of the alternative of producing automotive fuels from coal indicates that both the gasoline and the diesel engine should be replaced by the spark assisted diesel engine in the interests of energy economy.

by W. Tipler
Perkins Engines Co., England
Rept. No. SAE-750761 ; 1975 ; 12p 50refs
Presented at the 1975 SAE Off-Hwy. Vehicle Meeting,
Milwaukee, Wis., 8-11 Sep 1975.
Availability: SAE

HS-017 514

RELATIONSHIP OF ACCIDENT PATTERNS TO TYPE OF INTERSECTION CONTROL

The change in accident patterns accompanying a change in intersection control was investigated. The investigation included a review of previously made studies, an analysis of before and after accident data, and a detailed statistical analysis of a large, specially assembled, nationwide accident data base (comprehensive data form information from 250 intersections nationwide). Each data cell was defined by: geographic area, type of area, major-street volume, split between volume on major and minor approaches, and control. Each cell contained the following information: number of intersections and their serial numbers, number of intersection months of exposure, number of accidents, distribution of accidents by type and percentage; and number and percentage of accidents with fatalities, injuries, and property damage. Analysis of variance and regression techniques was used to show that the relationship of accident patterns to type of control must be represented by a complex model and that a simple-signal-no-signal division cannot explain changes in accident patterns. A large number of different measures of effectiveness describing changes in accident patterns were computed and analyzed. Hypothesis testing revealed that, although there was a definite shift in the distribution of accident types, there was no evidence that signalization, by itself, would lead to a significant decrease in net accident-related disability, especially for traffic signals not warranted by traffic volume. No conclusive evidence was found to justify a general reduction of minimum volume requirements for rural conditions or high-accident locations.

Publ: Transportation Research Record n540 p1-12 (1975)
1975 ; 14refs

Work sponsored by the American Assoc. of State Hwy. and Transportation Officials in cooperation with the Federal Hwy. Administration and conducted as part of the National Cooperative Hwy. Res. Proj. Publication sponsored by the TRB Com. on Control Devices.
Availability: See publication

HS-017 515

EFFECTS OF INCREASED ENFORCEMENT AT URBAN INTERSECTIONS ON DRIVER BEHAVIOR AND SAFETY

An attempt is made to define the nature and magnitude of the effects on driver behavior and safety resulting from increased levels of enforcement of traffic laws. Seven intersections (six study and one control) in Toronto, Ontario, Canada were chosen for study. Each study location received a different combination of duration (60, 120, or 180 minutes per day) and magnitude (1 or 2 motorcycle policemen, plainly visible, per location) of enforcement. The study consisted of 2 weeks of base data collection under prestudy conditions, 4 weeks of increased enforcement levels, and 2 weeks when levels were reduced to their original state. Results indicated that visible police presence at an urban intersection can significantly reduce the incidence of traffic violations. This effect appeared to be restricted to the time of actual police presence and disappeared almost immediately after the police left. Traffic conflicts were recorded as representing a measure of safety, but, although their effects were similar to those on violations, results were not judged significant. Based on effectiveness in reducing violations the most significant improvement occurred in employing a single policeman for a period of one hour per day. Further increase in effort did not produce appreciable further improvement.

by Peter J. Cooper
Publ: Transportation Research Record n540 p13-21 (1975)
1975 ; 10refs
Publication sponsored by the TRB Com. on Traffic Law Enforcement.
Availability: See publication

HS-017 516

DRIVER PERCEPTION OF PEDESTRIAN CONSPICUOUSNESS UNDER STANDARD HEADLIGHT [HEADLAMP] ILLUMINATION

Pedestrian conspicuousness under headlamp illumination is explored. A dark warehouse corridor equipped with standard low headlamps mounted on a stand, reflective white lines, and a target 42 inches from the floor and 550 feet from the headlamps was used as the test site. More detailed specifications for the variable transformer, photometric instrumentation, view box and illuminated targets, and head lamps are provided. Participants indicated by a switch light when the target was barely visible. First the target was bright enough to be specifically located; then it was blocked out. The surface was then illuminated gradually until all participants had responded. The procedure was carried out on five target areas from 24 x 72 inches to 1 x 1 inch. It was found that brightness and area are related to subjective driver interpretations of pedestrian conspicuousness. The performance of various reflective sur-

analysis. Applicable reflective treatments are proposed as safety countermeasures, and other potential contributing factors are discussed.

by Robert L. Austin; Donald J. Klassen; Robert C. Vanstrum
Publ: Transportation Research Record n540 p35-45 (1975)
1975; 16refs
Publication sponsored by the TRB Com. on Pedestrians.
Availability: See publication

HS-017 517

ASSESSMENT OF PEDESTRIAN ATTITUDES AND BEHAVIOR IN SUBURBAN ENVIRONMENTS

Suburban area pedestrianism was examined from the points of view of the walking and nonwalking public to relate pedestrian attitudes and behavior to the dimensions of the walking system and to recommend a set of guidelines and procedures for pedestrian system planning and design. Selected sites featured the three major types of pedestrian facilities: overpasses, tunnels, and at-grade crossings. Hour-by-hour observation and volume counting were performed to determine usage patterns, frequency of use, and user characteristics. Attitudinal surveys were administered to random samples of residents within the vicinity of each pedestrian facility being studied. Linkages between land uses were established to define reasons for local travel. Data were then analyzed to show how pedestrian facilities act to sustain the linkages. Various pedestrian characteristics were found to be related to walking activity: age has a direct bearing on walking behavior, and children constitute the largest walking group; acceptable walking distances of up to 0.25 mile were given for adults; and distances of up to 1 mile offer little impedance to children. Along with distance, fear of attack is a primary impedance to potential adult walkers, especially women. Overpasses were cited as the most desirable pedestrian accommodation to bypass traffic. Little enthusiasm was shown for tunnels because of the mischief they attract. People have also shown that, if reason exists, they will cross heavy traffic to travel by foot. Results give general principles for successful pedestrian planning in suburban areas, and they support the idea of combined pedestrian and bicycle paths.

by Michael J. Demetsky; Michael A. Perfater
Publ: Transportation Research Record n540 p46-55 (1975)
1975; 4refs
Publication sponsored by the TRB Com. on Pedestrians.
Availability: See publication

HS-017 518

REFLECTORIZED NUMBER (LICENCE) PLATES [REFLECTORIZED LICENSE PLATES] AND TRAFFIC SAFETY IN AUSTRALIA

Traffic accident data from the Australian Capital Territory (A.C.T.) and from Tasmania were examined for the years when reflectORIZED license plates were being introduced (September 1968-September 1969 for A.C.T. and April 1970-March 1971 for Tasmania). Attention was restricted to night-time rear-end and night-time parked vehicle collisions where one vehicle had a reflectORIZED plate and the other did not. The A.C.T. study was restricted to 4 p.m.-8 a.m. accidents and

torized plates did not affect effective crash countermeasures. However, there were indications in the Tasmanian data that the use of the reflectORIZED plates had a greater effect on the casualty crashes than on non-casualty crashes.

by Rodney G. Vaughan; Rosamond Wood
Department of Motor Transport, Traffic Accident Res. Unit,
Box 28, G.P.O., Sydney, N.S.W., Australia 2001
Rept. No. 1/75; 1975; 42p 21refs
Availability: Corporate author

HS-017 519

ROLLING RESISTANCE OF PNEUMATIC TIRES. INTERIM REPORT

Summaries of tire rolling resistance as influenced by tire construction and design, tire materials, and tire operating conditions (speed, vertical deflection, inflation pressure, vertical load, tread wear, steering effect, wheel and rim design, and roadway surface) are presented. Various methods for measuring tire rolling resistance are discussed: direct measurements (road vehicle, road trailer, roadwheel or dynamometer, and moving belt machine); coastdown measurement (road vehicle, and roadwheel or dynamometer); and vehicle fuel consumption measurement. Some economic factors in the possible development of lower rolling-loss tires are also assessed. It is indicated that current trends towards smaller, lighter automobiles and increasing usage of radial tires, in addition to reduced speed levels are positive contributions to improved automotive fuel economy.

by S. K. Clarke; R. N. Dodge; R. J. Ganter; J. R. Luchini
Regents of the Univ. of Michigan, Ann Arbor, Mich. 48104
Contract DOT-TSC-316
Rept. No. DOT-TSC-OST-74-33; PB-242 985; 1975; 75p
90refs
Rept. for May-Jul 1974.
Availability: NTIS

HS-017 520

CAPACITY ANALYSIS TECHNIQUES FOR DESIGN AND OPERATION OF FREEWAY FACILITIES. FINAL REPORT

The geometric features of highway design and planning must be determined largely through capacity analyses. A procedure based on the data and findings reported in the Highway Capacity Manual is presented as a tool in the planning and design of freeway facilities. A graphical method utilizing special nomographs and procedural steps has been developed to facilitate the understanding of highway capacity and its application to design of freeways. The subject is dealt with by a separate analysis of each component of the freeway (the freeway proper, ramps, and the sections where weaving is frequent), including numerous illustrative samples. The results are combined to reach a composite solution for design of the complete freeway facility or for its operating system. The analysis techniques and sample solutions of problems are presented both on the basis of the Manual approach and in accordance with the design policies of the American Association of State Highway Officials. Slight differences in the

philosophy and approach are explained and the two methods related.

by Jack E. Leisch
 Jack E. Leisch and Assoc., State National Bank Plaza, 1603
 Orrington, Suite 1290, Evanston, Ill. 60201
 Rept. No. FHWA-RD-74-24; 1974; 89p 11refs
 Sponsored by the Federal Hwy. Administration's Offices of
 Engineering, Res., and Devel.
 Availability: NTIS; GPO, \$2.15, stock number 050-001-00100-4

HS-017 521

PASSENGER NOISE ENVIRONMENTS OF ENCLOSED TRANSPORTATION SYSTEMS

The nonoccupational aspects of noise exposure inside enclosed transportation systems are examined. A task was initiated to collect and display (in tabular form) published and unpublished literature concerning the interior sound levels of: cars, commuter buses, intercity buses, commuter railroad cars, intercity railroad cars, fixed wing aircraft, helicopters, and hovercraft. Results are appended. A discussion of possible health and welfare effects and the measurement methodologies employed is included. The reference listings are accompanied by a key indicating the vehicle and information type encompassed by each article. A measurement project was undertaken simultaneously to complement by updating the data base derived from the literature survey, and to gain insight into measurement methodology issues and problems. Sound levels were measured inside the following passenger vehicles during various phases of operation: cars, commuter buses, trolley cars, commuter railroad cars, intercity railroad cars, and fixed wing aircraft. Measurements were made by Environmental Protection Agency personnel while enroute to and from business meetings. The data forms are appended. The data collected provided a base for: calculation of representative mean interior or sound levels of public transportation vehicles; assessment of the health ramifications of exposure to the interior sound levels of enclosed passenger vehicles; appraisal of measurement methodologies; and locating areas of data deficiency, and making recommendations with regard to health considerations, areas requiring further research, and measurement methodologies.

Environmental Protection Agency, Office of Noise Abatement and Control, 1921 Jefferson Davis Hwy., Crystal Mall 2, Arlington, Va. 20460
 Rept. No. EPA-550/9-75-025; 1975; 156p 122refs
 Availability: Corporate author

HS-017 522

ENGINEERING KNOW-HOW IN ENGINE DESIGN. PART 23. ENGINE DESIGN TO MEET NEW SOCIAL OBLIGATIONS

Aspects of engine design discussed are: fundamentals of the combustion process and combustion chamber design for low emissions; emissions formation characteristics of the diesel combustion process and estimated future development trends; a method for reducing the transmitted vibrations from single cylinder engines; and prechamber and valve gear design for 3-valve stratified charge engines.

Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, Pa. 15096
 Rept. No. SAE-SP-396; 1975; 69p refs
 Includes HS-017 523--HS-017 526. Presented as the 23rd of a series of annual lectures planned by the SAE Milwaukee Section.
 Availability: SAE

HS-017 523

COMBUSTION PROCESS FUNDAMENTALS AND COMBUSTION CHAMBER DESIGN FOR LOW EMISSIONS

Basic combustion process modification is discussed as means for emissions control. A general consideration of the formation of pollutants (unburned hydrocarbons, nitrogen oxide emissions, and carbon monoxide emissions) in spark ignition engines is included. Several stratified charge engines which can lead to reduced emissions are discussed: open chamber stratified charge engines (the Ford PROCO engine and the Texaco TCCS engine); divided chamber stratified charge engines; and large volume-fuel injected prechamber engines.

by H. K. Newhall
 University of Wisconsin, Mechanical Engineering Dept.
 Publ: HS-017 522 (SAE-SP-396) Engineering Know-How in Engine Design, Part 23, Engine Design to Meet New Social Obligations, Warrendale, Pa., 1975 p1-14
 Rept. No. SAE-751001; 1975; 25refs
 Availability: In HS-017 522

HS-017 524

EMISSION FORMATION CHARACTERISTICS OF THE DIESEL COMBUSTION PROCESS AND ESTIMATED FUTURE DEVELOPMENT TRENDS

Fuel consumption per capita and population trends are reviewed. It is suggested that any relaxation in diesel emission goals is undesirable. An analysis is made of the chemical, thermodynamic and fluid dynamic factors controlling the formation of nitric oxide, unburned hydrocarbon, carbon monoxide and exhaust smoke in diesel combustion. It is hypothesized that a reduction in the quantity of fuel burned in diffusion or increased mixing rates of air and fuel vapor will significantly lower emission levels. It is suggested, therefore, that future trends in direct injection combustion development will need to incorporate increased fuel atomization and toroidal air motion to achieve the required favorable combustion conditions. A comparison is made of commercially acceptable, state-of-the-art diesel engines developed to meet low emission levels and allows an estimate of the potential improvements from combustion development. It appears that intense mixing and good fuel atomization, characteristics of the prechamber process, are the keys to lower emissions and can yield up to 40% reductions in hydrocarbon and nitric oxide levels for the direct injection diesel combustion process. Hybrid engines combining the diesel and Rankine cycles are feasible for heavy duty engine applications. The combination of the highly efficient diesel cycle and a reciprocating steam engine using diesel engine exhaust energy is a potentially efficient, low emission, environmentally acceptable prime mover.

March 31, 1976

HS-017 528

by J. C. Hoelzer
J. I. Case Co.
Publ: HS-017 522 (SAE-SP-396) Engineering Know-How in
Engine Design, Part 23, Engine Design to Meet New Social
Obligations, Warrendale, Pa., 1975 p15-22
Rept. No. SAE-751002 ; 1975 ; 15refs
Availability: In HS-017 522

HS-017 525

REDUCING THE TRANSMITTED VIBRATIONS FROM SINGLE CYLINDER ENGINES

Simplified curves and equations are developed that can be used to predict the vibration level of a supporting structure from the action of the various vibration sources of a single-cylinder slider-crank mechanism. Using a chain saw as an example, the vibration levels from each major vibration source are presented together with the vibration level with various isolation stiffnesses. The vibration levels are reviewed to determine the design parameters necessary to meet a 0.5 g specification and a leaf spring-belt drive isolation concept is presented together with actual vibration spectra.

by Alfred W. Siman
Textron Corp., Homelite Div.
Publ: HS-017 522 (SAE-SP-396) Engineering Know-How in
Engine Design, Part 23, Engine Design to Meet New Social
Obligations, Warrendale, Pa., 1975 p 23-34
Rept. No. SAE-751003 ; 1975 ; 3refs
Availability: In HS-017 522

HS-017 526

PRECHAMBER AND VALVE GEAR DESIGN FOR 3- VALVE STRATIFIED CHARGE ENGINES

A historical summary of many significant patents and articles is given, pertaining to the 3-valve stratified charge spark-ignited internal combustion engine as a fuel saver. The 3-valve stratified charge engine uses a rich prechamber charge to provide the proper stratification. A basic requirement is that the fuel-air equivalence ratios of the charges in the two combustion chambers be 15% rich for the prechamber and 15 to 30% lean for the main chamber at the moment of ignition. A method using a computer analysis of engine breathing and carburetor air-flow to establish the proper fuel-air equivalence ratios of the two carburetors is explained. Typical valve gear and prechamber layouts relative to the auxiliary valve are illustrated for various types of engines. The importance of controlled charge turbulence and good charge mixing is demonstrated. It is concluded that: fuel-air equivalence ratios of the charges in the two combustion chambers should be in the range of 1.1 to 1.2 for the prechamber and 0.75 to 0.85 for the main chamber at ignition; a 20% improvement in fuel economy can be achieved with this engine as compared to the standard engine burning a rich charge; a three-fold reduction in nitric oxides emissions can be achieved by operating with the prescribed rich and lean charges; and reduction of hydrocarbon and carbon monoxide emissions can be achieved by very

by Michael C. Turkish
Eaton Corp.
Publ: HS-017 522 (SAE-SP-396) Engineering Know-How in
Engine Design, Part 23, Engine Design to Meet New Social
Obligations, Warrendale, Pa., 1975 p35-62
Rept. No. SAE-751004 ; 1975 ; 61refs
Availability: In HS-017 522

HS-017 527

DIESEL ENGINE NOISE CONFERENCE

Discussions of numerous aspects of engine noise are presented. Topics include: the problems of engine noise in different vehicle groups; a comparison of direct injection and indirect injection combustion systems' noise, emissions, and performance; the effect of turbocharging on noise, emissions and performance; the effect of the combustion system on engine noise; affecting diesel noise by the piston; the influence of transfer movement analysis on diesel piston design; piston slap noise of indirect combustion diesel engine; the relation of injection noise to fuel pump and engine noise; identification and modeling of rotary fuel injection pump noise processes; analysis and prediction of engine structure vibration; and modes of engine structure vibrations as noise sources. Also included are discussions of: a diesel engine vibration and noise modeling technique; techniques of structural vibration analysis applied to diesel engine noise reduction; idealization and response analysis applied to diesel engine noise assessment; practical means for reducing fast diesel engine noise; diesel engine design concepts with low noise emission; quieting techniques for diesels; and low noise opposed piston two-stroke engine and blower.

Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, Pa. 15096
Rept. No. SAE-SP-397 ; 1975 ; 225p refs
Includes HS-017 528--HS-017 546.
Availability: SAE

HS-017 528

THE PROBLEMS OF NOISE OF ENGINES IN DIFFERENT VEHICLE GROUPS

All current automotive engines are classified into four distinct groups relative to engine usage and vehicle noise legislation: goods or passenger vehicles (motor buses and motor coaches) over 12 tons and powered by engines 200 horsepower (hp) and over; goods or passenger vehicles exceeding 3.5 tons and powered by engines not exceeding 200 hp; goods or passenger vehicles not exceeding 3.5 tons; and private motor cars. The noise characteristics of the engines in each are widely different except that at their maximum rated speeds the overall noise levels approach the same value (91-92 decibels at 25 feet, 89 decibels at 25 feet, 85 decibels at 25 feet, and 84 decibels at 25 feet, respectively). It is concluded that: all current automotive engines can reach the same high level of emitted noise at their maximum speeds but with gasoline and high speed indirect induction diesel engines there is an an-

by T. Priede
University of Southampton, Automotive Engineering Group,
England
Publ: HS-017 527 (SAE-SP-397) Diesel Engine Noise
Conference, Warrendale, Pa., 1975 p1-12
Rept. No. SAE-750795; 1975; 6refs
Availability: In HS-017 527

HS-017 529

NOISE, EMISSIONS AND PERFORMANCE OF THE DIESEL ENGINE. A COMPARISON BETWEEN DI [DIRECT INJECTION] AND IDI [INDIRECT INJECTION] COMBUSTION SYSTEMS

A study of a direct and an indirect injection system on a V-10 diesel engine in regard to noise, exhaust and fuel consumption is presented. The engine was mounted on an anechoic test stand. The dependency of the sound pressure levels on engine speed, engine load and injection timing is described for both systems. The noise reduction achieved by optimization of injection timing is shown in relation to the respective changes in exhaust and smoke emission output and fuel consumption. It was found that: if the timing is adjusted to obtain optimum output and fuel consumption, the indirect injection engine (working on the pre-chamber principle) has more favorable noise and exhaust emission characteristics, at the expense of a rise in fuel consumption of approximately 10%; and the direct injection engine characteristics can be improved by varying the injection timing but only to a limited degree in view of the resulting deterioration in fuel consumption and smoke.

by Frank W. Leipold; Horst O. Hardenberg
Daimler-Benz, AG, West Germany
Publ: HS-017 527 (SAE-SP-397) Diesel Engine Noise
Conference, Warrendale, Pa., 1975 p13-22
Rept. No. SAE-750796; 1975; 5refs
Availability: In HS-017 527

HS-017 530

EFFECT OF TURBOCHARGING ON DIESEL ENGINE NOISE, EMISSIONS AND PERFORMANCE

The overall effect of two methods of turbocharging a direct injection four stroke diesel engine (turbocharger only, and matched turbocharger with alterations in compression ratio and fuel injection system and higher power rating) in terms of performance, smoke, noise and gaseous emissions is described. The general method of assessing a diesel engine is discussed. Emissions measurements are made in a steady-state cycle on an engine dynamometer. A smoke meter and cylinder pressure transducer are used to measure smoke and noise. The characteristics of a normally aspirated direct injection diesel engine are discussed: open exhaust noise; open air inlet noise; combustion noise; measured noise characteristics; and carbon monoxide (CO), hydrocarbon (HC), and nitric oxide (NO) emissions. For the matched turbocharger it was found that: the engine output increased from 0.29 horsepower per cubic inch to 0.39 horsepower per cubic inch; specific fuel consumption increased 6%; smoke levels under steady state conditions is much improved; at rated speed and load the overall combustion excitation level is reduced by 16 decibels, but at part load conditions, levels are up to 8 decibels greater; overall measured noise is reduced up to 6 decibels; open air inlet noise is increased up to 10 decibels; open exhaust noise is

reduced, but NO's are not affected much. For the unaltered turbocharged engines, it was found that: slightly more specific fuel consumption and smoke levels are created; over the majority of light load conditions combustion noise levels are lower than for both the naturally aspirated and matched turbocharged engine; and HC levels are reduced, CO levels are not affected much, and NO's levels are lower than for the other two engines.

by D. Anderton; V. K. Duggal
University of Southampton, Automotive Engineering Group,
England
Publ: HS-017 527 (SAE-SP-397) Diesel Engine Noise
Conference, Warrendale, Pa., 1975 p23-35
Rept. No. SAE-750797; 1975; 23refs
Availability: In HS-017 527

HS-017 531

THE EFFECT OF COMBUSTION SYSTEM ON ENGINE NOISES

The effects of using different combustion systems on engine noise are reviewed including an examination of noise reduction methods such as shielding and enclosure (not more than a decibel reduction) and structural modifications (limited to a decibel reduction). The use of turbocharging is examined as the limiting effects of mechanical noise (piston slap) are noted. The variation of exhaust emission levels with reduction in combustion noise is included. The following graphed measurements are provided: a comparison of gasoline and diesel cylinder pressure diagrams and radiated noise spectra; noise reductions using shields and enclosures; the effect of applying pilot injections to an indirect injection (IDI) diesel on cylinder pressure development and radiated noise; the effect of injection timing on noise; the effects of timing on performance; comparison of direct injection (DI) and IDI cylinder pressure diagrams at various timings; engine noise prediction curves; the effect of turbocharging on DI cylinder pressure frequency spectra; the effect of turbocharging on radiated noise; cylinder pressure frequency spectra at full load and rated speed; free acceleration and steady state noise levels; engine structural vibration and radiated noise (truck size engine at light duty engine); bending waves in plates; and a comparison of in-line and rotary gasoline engines.

by Bernard J. Challen
Ricardo and Co. Engineers (1927) Ltd., England
Publ: HS-017 527 (SAE-SP-397) Diesel Engine Noise
Conference, Warrendale, Pa., 1975 p36-50
Rept. No. SAE-750798; 1975; 14refs
Availability: In HS-017 527

HS-017 532

AFFECTING DIESEL ENGINE NOISE BY THE PISTON

Methods of affecting engine piston movements and the impact of the piston, as it hits the cylinder wall (piston slap), are means of measurements with pistons whose pins are not offset, on which the axis of piston and pin coincide, are considered. Measurements are described with positively and negatively offset pins (pin axis slightly displaced with respect to piston axis). Various designs of pistons with controlled thermal expansion and of the articulated piston, which allows a red

pistons and the influence of skirt coatings on piston noise are reported.

by Manfred D. Rohrlé
Mahle, GmbH, West Germany
Publ: HS-017 527 (SAE-SP-397) Diesel Engine Noise
Conference, Warrendale, Pa., 1975 p51-67
Rept. No. SAE-750799 ; 1975 ; 15refs
Availability: In HS-017 527

HS-017 533

TRANSVERSE MOVEMENT ANALYSIS AND ITS INFLUENCE ON DIESEL PISTON DESIGN

Advances in the development of a theoretical analysis of piston movement are described, covering the introduction of such new features as non-parallel bores, ring/groove friction, conservation of angular momentum at impact, and kinetic energy loss at impact. A single value of friction co-efficient of 0.2 inches is derived from experimental data and the new program is shown to give good agreement with measured piston movement traces. The piston movement program is used to examine several piston design features (gudgeon pin offset, piston/liner clearance, skirt length, gudgeon pin height, and center of gravity offset) in respect to their influence on impact severity. Gudgeon pin offset, height, and piston/liner clearance are considered the most important to piston noise. Further study on the features of friction and impact conditions are suggested, and the work is seen to have wider implications in the development of a complete set of piston assembly predictive design techniques. All experimental work was performed in a Perkins AT6 354 diesel engine equipped with four miniature inductive displacement transducers to measure one piston's movement under all conditions.

by R. Munro; A. Parker
Wellworthy, Ltd., England; A. E. Developments Ltd., England
Publ: HS-017 527 (SAE-SP-397) Diesel Engine Noise
Conference, Warrendale, Pa., 1975 p68-79
Rept. No. SAE-750800 ; 1975 ; 14refs
Availability: In HS-017 527

HS-017 534

PISTON SLAP NOISE OF INDIRECT COMBUSTION DIESEL ENGINE

Some calculated results to predict piston noise are given and the results are compared with measured information on engine noise and cylinder liner vibration where piston slap control measures have been taken. A Mitsubishi 4DR5, 4-cycle, 4-cylinder, water-cooled, swirl chamber diesel engine was used in the slap test comparing noise levels at different engine loads and before and after removing certain engine parts. The effects of piston to bore clearance on piston slap and of other types of pistons (lowered oil ring, oil cushioned, and pin offset) in reducing slap induced noise are calculated. It is concluded that the reduction of piston slap is very important to reduce engine noise at both low and high speeds; gudgeon pin offsetting is a very effective method to control slap (easy and economical to put into current production engines); the location of the center of gravity has a big influence on the best position of the gudgeon pin center against piston slap; and it is possible to make a reasonably accurate prediction of the effect of piston slap induced noise in the engine.

by Takashi Usami; Shinji Wada; Shigeru Sonoda
Mitsubishi Motors Corp., Japan
Publ: HS-017 527 (SAE-SP-397) Diesel Engine Noise
Conference, Warrendale, Pa., 1975 p80-8
Rept. No. SAE-750801 ; 1975 ; 6refs
Availability: In HS-017 527

HS-017 535

INJECTION NOISE AND ITS RELATION TO FUEL PUMP AND ENGINE NOISE

The noise generation of a diesel engine injection nozzle was investigated on a diesel truck engine in an anechoic chamber equipped with an exterior dynamometer and a television camera. The influence of the following noise components in relation to speed and load are determined: mechanical noise component (the driven engine); combustion; the nozzles; and the injection pump. In the nozzle tests, the nozzles were adjusted according to the production settings for the subject engine. It is concluded that: the reduction of nozzle noise can be best achieved by reducing the injection needle mass; injection frequency and holder design are also major components of the radiated nozzle assembly noise; and above idle quantity there is almost no influence of injection quantity to the nozzle noise.

by Klaus D. Zimmermann
Robert Bosch GmbH, West Germany
Publ: HS-017 527 (SAE-SP-397) Diesel Engine Noise
Conference, Warrendale, Pa., 1975 p89-100
Rept. No. SAE-750802 ; 1975 ; 4refs
Availability: In HS-017 527

HS-017 536

IDENTIFICATION AND MODELING OF ROTARY FUEL INJECTION PUMP NOISE PROCESSES

The contribution to the noise of automotive diesel engines from a rotary fuel injection pump is assessed by comparing its overall noise with that of a number of engines, to which the pump is, or may be fitted. The noise from a pump with two 10 millimeter plungers (the noisiest) is compared with the noise of complete 4-10 liter running engines. Engines were installed in an anechoic test chamber for the comparisons. The noise generating mechanisms (radiating surfaces, and paths formed in the internal structure) of the pump are examined. The cam and advanced piston assembly is modelled and two improvements, suitable for present mass production and capable of reducing overall pump noise by 3 to 5 decibels (reduction of drive line backlash by the single piece drive shaft and a stiffer pump housing) are described.

by A. J. Herbert; M. F. Russell
Cay Ltd., England
Publ: HS-017 527 (SAE-SP-397) Diesel Engine Noise
Conference, Warrendale, Pa., 1975 p101-8
Rept. No. SAE-750803 ; 1975 ; 5refs
Availability: In HS-017 527

HS-017 537

ANALYSIS AND PREDICTION OF ENGINE STRUCTURE VIBRATION

Part of an attempt to predict diesel engine noise and vibration characteristics at the design stage is reported. The surface

vibration and noise levels were predicted with simplified two-dimensional plate structures (similar in size to the side of a small diesel engine) and a simple three dimensional model, and were compared with measured vibration levels. The plates were made from traditional diesel engine materials and vibrated by a shaker mounted on the test rig to provide basic data for mode shape and response prediction. Various plate configurations and a sumplike structure were tested as an extension to three-dimensional theory. Both running engine and component tests were undertaken to measure engine mode shapes, damping and resonant frequencies. In static tests measurements of impedance and structural linearity were also made. Mode shapes are given for the in-line 6-cylinder diesel engine. The majority of the analysis was done digitally using transform and statistical techniques.

by M. G. Hawkins; R. Southall
Perkins Engines, Ltd., England
Publ: HS-017 527 (SAE-SP-397) Diesel Engine Noise
Conference, Warrendale, Pa., 1975 p109-19
Rept. No. SAE-750832 ; 1975 ; 12refs
Availability: In HS-017 527

HS-017 538

MODES OF ENGINE STRUCTURE VIBRATION AS A SOURCE OF NOISE

The overall model characteristics of a simplified engine structure are analyzed theoretically using finite element programs and a comparison is made with experimental results obtained on an equivalent physical model cast in one piece to minimize damping. An electrodynamic shaker was used as the source of excitation. The mechanism of excitation by the forces in each cylinder is analyzed in conjunction with experimental results of static deflection tests (pumping high pressure oil into the combustion chamber of one cylinder and measuring the resultant distortion of the engine structure). In order to determine which vibration predominated, a gaseous charge is ignited in the combustion chamber of a non-running V8 engine (the Banger test). Also presented are the results of a study into the optimum way of isolating a light panel from block induced vibration. The acoustic power radiated by representative modes of engine vibration through the acoustically important frequency range is discussed and some results of directivity tests are also given. It is concluded that: if the exciting forces are fixed in magnitude and form, vibration depends upon the model characteristics of the structure and the distribution of exciting forces; it is possible to predict designed noise production at an acceptable cost using finite element techniques; the engine initially performs as a solid, elastic plate; plate modes become more difficult to identify as frequency increases and individual panel modes predominate; the peak in the noise spectrum envelope around 1000 hertz is observed on many engines has been shown to be due to coincidence effects; considerable variations in sound pressure level occur around the engine; and the engine side radiates most strongly from its edges rather than from the middle.

by N. Lator; M. Petyt
University of Southampton, Inst. of Sound and Vibration Res., England
Publ: HS-017 527 (SAE-SP-397) Diesel Engine Noise
Conference, Warrendale, Pa., 1975 p120-33
Rept. No. SAE-750833 ; 1975 ; 17refs

HS-017 539

SIMPLE MODEL TECHNIQUE FOR BETTER UNDERSTANDING OF DIESEL ENGINE VIBRATION AND NOISE

A method of predicting the dynamic behavior and the radiating noise of the diesel engine structure is described. A simple structure model was used to develop noise and vibration-predictive design criteria. Natural frequencies and the vibration modes of the structure are calculated by the finite element method and the results are ascertained both by accelerometers and holography. It was found that holography was more effective for accurate measurements of vibration modes and phase than accelerometers. A very good agreement was observed between the calculated results and the actual measurements. Holography was applied to engine block vibration modes of the Isuzu V10. It appears to be possible to predict frequencies and levels responsible for major peaks in the engine block noise spectrum at the design stage with comparatively short computer run time and low cost.

by Kazuomi Ochiai; Masaharu Aisaka; Seiji Sakata
Isuzu Motors, Ltd., Japan
Publ: HS-017 527 (SAE-SP-397) Diesel Engine Noise
Conference, Warrendale, Pa., 1975 p134-45
Rept. No. SAE-750834 ; 1975 ; 1ref
Availability: In HS-017 527

HS-017 540

TECHNIQUES OF STRUCTURAL VIBRATION ANALYSIS APPLIED TO DIESEL ENGINE NOISE REDUCTION

Several techniques used to quantitatively define noise caused by engine structural vibration are described. Techniques included operating engine tests and bench tests. Analytical techniques showing vibration-causing critical engine components are also presented. Examples illustrating practical solutions for diesel engine noise reduction are thereby developed. Running engine noise source identification techniques include: the lead covering technique, and the vibration measurement/computation. Problem analysis techniques are described: non-running engine vibration techniques (swept-sine excitation technique, impulse-frequency response technique, and mode shape analysis); and the finite element analysis technique. Also discussed are techniques for determining problem solutions (for load carrying structures and non-load carrying structures). It is concluded that use of these structural vibration analysis techniques can yield reductions of 5 to 15 decibels in contributed sound pressure levels of the problem areas.

by R. S. Lane; S. E. Timour; G. W. Hawkins
Cummins Engine Co., Inc.; Massachusetts Inst. of Tech.
Publ: HS-017 527 (SAE-SP-397) Diesel Engine Noise
Conference, Warrendale, Pa., 1975 p146-55
Rept. No. SAE-750835 ; 1975 ; 20refs
Availability: In HS-017 527

HS-017 541

THE APPLICATION OF IDEALIZATION AND RESPONSE ANALYSIS TO DIESEL ENGINE NOISE ASSESSMENT

A method of determining the contributions to noise radiated by a diesel engine using idealization and response analysis is described. An idealization of the engine surface as a set of flat plates is used to calculate radiation efficiency from physical properties and edge constraints of each plate, and the velocity response of the engine surface is measured using accelerometers. The engine was run at three speeds and three load conditions at each speed. This data is used in a simple acoustical power relationship to determine 1/3 octave sound pressure levels under free field conditions for the engine and individual noise sources on the engine. The theory is discussed and an example of the application of the method is given, and compared briefly with the more traditional noise source identification technique of lead cladding. It is concluded that: overall noise levels can be calculated to within 2 decibels of measured levels and within 6 decibels in each 1/3 octave band; the radiation efficiency of the engine surface can be calculated from an idealization of the surface as a set of independent vibrating plates, without using microphone measurements; this method can obtain results quickly and more economically than lead cladding methods; and digital analysis provides an exceptionally flexible method of analyzing vibration and noise.

by P. J. Yorke
Perkins Engines Co., England
Publ: HS-017 527 (SAE-SP-397) Diesel Engine Noise Conference, Warrendale, Pa., 1975 p156-67
Rept. No. SAE-750836 ; 1975 ; 6refs
Availability: In HS-017 527

HS-017 542

PRACTICAL MEANS FOR REDUCING THE NOISE OF FAST DIESEL ENGINES

Major efforts in high speed diesel engine noise reduction are discussed. Early efforts resulted in a substantial reduction of the characteristic diesel engine noise at idling speed as well as in a substantial improvement of acoustical comfort within the vehicle passenger compartment. Recent studies aimed at reducing the external noise level of such vehicles in urban traffic are considered. The influence of the main engine parameters (cooling fan, engine rotation speed, injection start, and engine output) is discussed and main engine noise sources (oil sump; engine front, mainly timing case cover; and cylinder-head cover) are considered. Significant progress has already been made to reduce noise connected with fuel injection and combustion. The possibility of reducing noise by means of insulating screens and absorbing materials in the engine compartment is investigated. A 2 decibel reduction of external noise has been obtained with shields of 0.9 millimeter steel plates arranged below the engine-gearbox assembly. The development of sound-proofing shields appears to be the best means of external noise control. No more than a 4 to 5 decibel improvement in external noise can realistically be expected. It is concluded that most solutions retained or contemplated for reducing the external noise levels of diesels are applicable to cars with spark ignition engines.

by M. Le Creurer; M. Marty
Automobiles Peugeot, France
Publ: HS-017 527 (SAE-SP-397) Diesel Engine Noise Conference, Warrendale, Pa., 1975 p168-78
Rept. No. SAE-750837 ; 1975 ; 6refs
Availability: In HS-017 527

HS-017 543

DESIGN CONCEPTS OF DIESEL ENGINES WITH LOW NOISE EMISSION

The sources of diesel engine noise are analyzed: exhaust, intake, engine accessories, parts connected to the engine, and the engine surface. Methods for noise abatement are described: treatment of individual engine components, acoustic enclosures for existing engines, and design concepts for future low noise engines. Various concepts for light weight acoustic engine casings closely fitted to the engine without acoustical lining or even integrated into the engine structure and providing a 15 to 20 decibel noise reduction are demonstrated, including one concept for future light weight engines featuring a sound attenuating housing. A part of the engine housing is replaced by a sound attenuating casing which then also provides the sealing of the oil chambers leading to the confinement of the structural vibrations to only the crankdrive, the central support and the cylinder head of the engine. It is concluded that the remarkable noise reduction which can be achieved with various engine enclosures, both on a decibel scale and subjectively, demonstrates an approach clearly superior (in cost and performance) to the technique of step by step improvements as they are unfortunately promoted by present noise legislation.

by Gerhard E. Thein; Heinz A. Fachbach
AVL, Austria
Publ: HS-017 527 (SAE-SP-397) Diesel Engine Noise Conference, Warrendale, Pa., 1975 p179-94
Rept. No. SAE-750838 ; 1975 ; 21refs
Availability: In HS-017 527

HS-017 544

TECHNIQUES FOR QUIETING THE DIESEL

Reduction of diesel engine noise in a cost-effective manner requires quantitative identification of the noise levels radiated by the different engine surfaces. The source identification enclosure technique, involving total incapsulation of the engine and exposure of the various noise contributors (cooling system, exhaust, intake, engine surface and accessories and power conversion unit) to analyze specific noise characteristics, is discussed and test variation techniques are presented. In addition, the techniques of optimum mass and stiffness distribution, shielding, damping and isolation are considered and results of typical treatments are shown. It is concluded that: proper stiffness and mass distribution can provide 3-4 decibels reduction, but must be balanced against weight limitations; shielding various engine parts is an effective noise reduction technique when properly designed with adequate transmission loss, sealing, isolation, and area coverage; damping is particularly effective where the noise is due to radiation from resonant vibration modes; for engine covers, maximum reductions of 5-6 decibels are typical; and isolation of engine components is effective, especially at the higher frequencies.

by D. F. Kabele; G. A. Anderkay
John Deere Waterloo Tractor Works
Publ: HS-017 527 (SAE-SP-397) Diesel Engine Noise
Conference, Warrendale, Pa., 1975 p195-203
Rept. No. SAE-750839; 1975; 15refs
Availability: In HS-017 527

HS-017 545

LOW NOISE OPPOSED PISTON TWO-STROKE ENGINE AND BLOWER

The noise of a rocker-opposed piston two cycle diesel engine is investigated. Known noise reduction features (shielding different components) are applied to the engine without significant decibel reduction. The Roots type scavenge blower used on the two-cycle engine is redesigned to produce a low noise machine suitable for the low noise engine. The specifications for a new blower, the Convel blower, are provided. The final assembly of engine and blower demonstrated that the noise regarded as characteristic of the two-cycle engine is caused by the Roots blower and when it is eliminated the noise level can be quite low. The Convel blower is an example of how rethinking the basic requirements of an engine can lead to a new design more suited to modern requirements. It is concluded that for the low noise rocker opposed engine the rigidity of the piston linkage and crankshaft system and the mode of transmission of its vibration to the engine frame should be recognized as important design features.

by D. W. Tryhorn; H. L. Pullen; E. C. Grover
Sir W. G. Armstrong Whitworth and Co., (Engineers) Ltd.,
England; University of Southampton, Inst. of Sound and
Vibration Res., England
Publ: HS-017 527 (SAE-SP-397) Diesel Engine Noise
Conference, Warrendale, Pa., 1975 p204-14
Rept. No. SAE-750840; 1975; 3refs
Availability: In HS-017 527

HS-017 546

NOISE--THE DIESEL ENGINE DESIGNERS' DILEMMA

An attempt is made to put into perspective the noise position of the automotive diesel for the present and the future. The following aspects of diesel engine noise are discussed: the legal target noise levels (1975, 1976, 1980, and 1984); engine noise characteristics; and noise components (mechanical noise, and combustion noise). The future of diesel engine noise reduction is also considered. The moving parts, the structure, and the combustion of the engine must be given the greatest attention in future work.

by A. M. Porkess; R. J. Rice
British Leyland, Ltd., Truck and Bus Div., England
Publ: HS-017 527 (SAE-SP-397) Diesel Engine Noise
Conference, Warrendale, Pa., 1975 p215-21
Rept. No. SAE-750841; 1975; 3refs
Availability: In HS-017 527

HS-017 547

EYE FIXATIONS OF DRIVERS IN NIGHT DRIVING WITH THREE HEADLIGHT [HEADLAMP] BEAMS. FINAL REPORT

Research was conducted to obtain information on the manner in which the beam pattern of headlamps affects the way drivers obtain visual information in night driving. Two drivers (aged 25 and 40) drove an automobile in the daytime and at night (on a specified 15 mile course at 40-50 mph on 4 days and 4 nights) using American and European low beam headlamps and an experimental mid beam. The eye fixations of the drivers were measured, using a head-mounted silicon diode TV camera and light reflection from the cornea. Superimposition of the corneal light reflection upon the image of the roadway scene allowed recordings to be made of the eye fixations of drivers on the two-lane road course. It was shown that: dwell time was longer when looking straight ahead at night than in the daytime; there was a reduction in the proportion of the viewing time devoted to the left lane at night, when there was no oncoming vehicle; drivers looked at approaching vehicles in both day and night conditions with glance durations of intermediate lengths, which increased in frequency as the separation distance between the vehicles decreased; and at night, preview distances were less than in the day. The characteristic shift of the eye fixations in the direction taken by the road was found in both day and night driving. It was also found that: at night on left curves the American and European low beams provided the eye fixations most closely resembling those used in daytime; and on straight sections and right curves the mid beam provided the most compatible distribution of glances. It is suggested that an improved meeting beam should incorporate characteristics of the European low beam, to provide illumination on the left of the lane, and those of the mid beam, to provide greater visibility along the lane and to the right of it.

by Rudolf G. Mortimer; Craig M. Jorgeson
University of Michigan, Hwy. Safety Res. Inst., Ann Arbor,
Mich. 48105
Contract UM-7102-C128
Rept. No. UM-HSRI-HF-74-17; 1974; 29p 8refs
Sponsored by Motor Vehicle Mfgs. Assoc., Inc. See also HS-017 348.
Availability: Corporate author

HS-017 548

THE DEVELOPMENT AND COMPARATIVE EVALUATION OF ANALYTICAL TIRE MODELS FOR DYNAMIC VEHICLE SIMULATION. FINAL REPORT

The development of improved tire models suitable for inclusion in dynamic vehicle simulations is described and their performances are compared to provide guidelines for model selection and use. Four basic tire models, representing extensions of previous analyses, were developed. They range from the simple non-enveloping point contact model to the fully enveloping adaptive footprint model including both inflation pressure and carcass stiffness effects, and simulating dynamically varying footprint. Analyses and governing equations for the vertical and fore-and-aft tire forces arising during operation over non-yielding ground are presented for each model.

through dynamic simulations of a light truck crossing typical unimproved roads. Suspension hardening characteristics and wheel hop capability are included. Time histories and power spectral densities of transmitted tire forces and vehicle motion obtained with each model are presented. Comparison of the results shows that the simpler tire models overestimate the transmitted forces, particularly at the higher frequencies. It is also shown that, at the primary resonant frequencies of vehicle vibration, the basic tire and suspension nonlinearities play a dominant role.

by Khushroo M. Captain; David N. Wormley; Edvard Grande Foster-Miller Associates, Inc., 135 Second Ave., Waltham, Mass. 02154

Contract DAAE07-73-C-0331

Rept. No. TR-11877; TAC-7333; AD-A005415 ; 1974 ; 108p 37refs

Rept. for Jul-Dec 1973. Prepared for the Army Tank Automotive Command, Warren, Mich.

Availability: NTIS

HS-017 549

IDENTIFICATION OF ELASTOMERS IN TIRE SECTIONS BY TOTAL THERMAL ANALYSIS. 2. WHITE SIDEWALL COMPOUNDS OF EPDM AND BLENDS

The elastomers in white sidewall compounds of ethylene-propylene-diene rubber (EPDM) and blends are identified by total thermal analysis: differential scanning calorimetry (DSC); thermogravimetry (TG); determination of glass transition temperatures; and derivative thermogravimetry (DTG) in nitrogen and oxygen. All TG experiments were carried out at 150 torr pressure. Three kinds of samples were used for the experiments: peroxide-cured; sulfur-cured compounds of white sidewall recipes; and white sidewall sections from tires. A few black-reinforced compounds in a conventional sulfur recipe were included for comparison. All polymers were commercial samples and were used as such. Peak temperatures were obtained by extrapolation of the straight lines from two sides of the peak. Elastomers used were NR (AMA-7), SBR(1500), EPDM (Royalene 502, Vistalon 4608, and Vistalon 2504), and CIIR (HT 10-66, and HT 10-68). It was found that: total thermal analysis curves can identify all polymers in the blends of EPDM and other elastomers used for white sidewalls; DSC and DTG curves in nitrogen are most promising, while those in oxygen can be used as corroborative evidence; there is close correspondence between DSC and DTG peak temperature for the elastomers that degrade by endothermic reaction (EPDM, CIIR); and the difference in glass transition temperature of the many combinations is not big enough, but this also provides corroborative evidence. The method has been tried in analyzing white sidewalls from commercial tires and was found to give results in good agreement with infrared analysis in most cases.

by A. K. Sircar; T. G. Lamond

Publ: Rubber Chemistry and Technology, v48 n4 p631-9 (Sep-Oct 1975)

1975 ; 7refs

Availability: See publication

HS-017 550

IDENTIFICATION OF ELASTOMERS IN TIRE SECTIONS BY TOTAL THERMAL ANALYSIS. 3.

WHITE SIDEWALL COMPOUNDS OF NEOPRENE RUBBER BLENDS

The elastomers in white sidewall compounds of neoprene rubber blends were identified by total thermal analysis: differential scanning calorimetry (DSC), glass transition temperature (T_g), thermogravimetry (TG), and derivative thermogravimetry (DTG). All TG experiments were carried out at 150 torrs pressure. Three kinds of samples were used for the experiments: peroxide-cured; sulfur-cured with or without carbon black; and sections from tires. Recipes for the sulfur-cured compounds are presented. All polymers were commercial samples and were used as such. Peak temperatures were obtained by extrapolation of the straight lines from two sides of the peak. Neoprene W was the polychloroprene rubber used in the study. It was found that: DSC curves of sulfur-cured CR differ from peroxide-cured vulcanizates in the shape of the exotherm and the peak temperatures; the exothermic reaction, attributed to dehydrochlorination and subsequent crosslinking, is accelerated by sulfur; in blends with NR, BR, and SBR, the second polymer intervenes in the crosslinking reaction, resulting in a lower residual weight for the CR network; and white sidewall compounds of NR/CR or NR/CR/CSM can be identified by their DSC peaks in nitrogen, glass transition temperature, and DTG peaks.

by A. K. Sircar; T. G. Lamond

Publ: Rubber Chemistry and Technology, v48 n4 p640-52 (Sep-Oct 1975)

1975 ; 5refs

Availability: See publication

HS-017 551

IDENTIFICATION OF ELASTOMERS IN TIRE SECTIONS BY TOTAL THERMAL ANALYSIS. 4. INNERLINER

A total thermal analysis of the innerliners of tires was conducted to identify elastomers. The analysis consisted of differential scanning calorimetry (DSC), thermogravimetry (TG), derivative thermogravimetry (DTG), and glass transition temperature (T_g) carried out at 150 torrs pressure. Two kinds of samples were used: vulcanizates of typical liner compounds, with and without carbon black; and sections from tires. Seven commercial polymers and a typical innerliner recipe were used. Slabs were formed and cured for 45 minutes at 153 C. The compositions of the tire samples were obtained by infrared analysis of the sample. Butyl and halogenated butyls are clearly indicated by DSC and DTG in nitrogen. Binary NR/CIIR blends are also easily characterized by combined DSC and DTG techniques. In ternary SBR/CIIR/NR blends, only CIIR and NR show up in DTG curves when SBR occurs as a minor component. Minor indication of SBR is obtained from DSC curves. Thermal methods fail to distinguish between BIIR and CIIR. It was also found that: in elastomer blends, DTG peak temperatures may vary over a wide range depending on the type of the second elastomer; the thermal stability of the polymers is not materially affected by the presence of another polymer, thus giving rise to the weight-loss peaks at well-defined temperatures, characteristic of each polymer; and except for SBR/BR blends, which show a single T_g changing with composition, all other elastomer blends show transitions at the respective temperatures, indicating the inherent incompatibility of elastomers.

HS-017 552

THERMOANALYTICAL METHODS IN VULCANIZATE ANALYSIS. 2. DERIVATIVE THERMOGRAVIMETRIC ANALYSIS

The use of derivative thermogravimetry (DTG) in qualitative and quantitative analysis of raw polymers, compounds, and vulcanizates is described. Elastomers used include: polyisoprene, polybutadiene, liquid polybutadiene, polyisobutylene, EPDM, and emulsion and solution SBR rubbers. Laboratory stocks and control compounds were prepared on either a 75 x 200 millimeter or a 150 x 300 millimeter mill. All factory masterbatches were regular production Banbury mixes. Programming and recording facilities for the duPont 951 TG-DTG (analyzer) were provided by a duPont 990 module. Samples (cut from the center of the batch) were all around 10 milligrams in size. Samples were program-heated at 10 C per minute from 100 C to 550 C under a nitrogen atmosphere, switched to an air or oxygen atmosphere, and heated finally to 600 C. All carrier gas flows were monitored with flow meters. The primary weight-loss curve and the first derivative were recorded simultaneously. It was found that: elastomer, ratio, carbon black, oil/plasticizer, and inorganic pigments can be determined in about 35 minutes by TG/DTG, at a scan rate of 10°C per minute; the time can be reduced by increasing the scan rate, but interference from highly exothermic reactions can be a limiting factor; and the main problem in the identification of unknown blends by DTG is that many commercial elastomers have very similar thermal stabilities, which results in DTG peaks in the same temperature range.

by D. W. Brazier; G. H. Nickel
Publ: Rubber Chemistry and Technology v48 n4 p661-77 (Sep-Oct 1975)
1975; 15refs
Presented at the meeting of the Rubber Div. of the American Chemical Society, Cleveland, Ohio, 6-9 May 1975.
Availability: See publication

HS-017 553

CONCEPTS IN SAFETY BELT TESTING. FINAL REPORT

Concepts for more representative testing of emergency-locking retractors (inertia reels) and shoulder harness automobile occupant restraint assemblies were explored. It was determined that a vehicle acceleration pulse having a low acceleration onset would be the most critical condition for retractor performance. A mockup of a single retractor acceleration test device (illustration provided) was fabricated for producing constant onset values in the lower range estimated for aircraft accidents. Preliminary testing with the mockup test device raised questions on the locking characteristics of current retractor designs, but the results were inconclusive. It was found that shoulder harness assemblies should be tested as an assembly to properly assess the interaction of the various segments on buckles and webbing connectors. A static test method was explored (with a new test block design based on a 50th percentile male), and found to be potentially adaptable to

SAE Recommended Practice No. J117, presenting a concept minimizing the potential for a double standard between dynamic and static criteria, is considered. Based on this concept, a discussion is presented on aspects to consider in designing an accurate and repeatable dynamic test procedure: the dynamic test concept and its rationale, the acceleration vehicle, the method of acceleration, acceleration pulse parameters, calibration safety belt, safety belt dynamic test device, test equipment response, and dynamic test instrumentation.

by James W. Ross, Jr.
Federal Aviation Administration, Flight Standards Technical Div., Oklahoma City, Okla. 73125
Rept. No. FAA-TR-FS-75-782-120A; SAE-750540; 1975; 40p; 16refs
Prepared for the Society of Automotive Engineers' Business Aircraft Meeting, Wichita, Kansas, 8-11 Apr 1975.
Availability: NTIS

HS-017 554

HUMAN FACTOR AND HARDWARE DESIGN CONSIDERATIONS FOR PASSENGER PROTECTION IN HIGH SPEED CRASHES

Significant human factor considerations for restraint and protection of passengers involved in barrier type collisions at speeds up to 300 mph are identified and summarized. The considerations result in computed values of minimum stopping distance as a function of initial velocity. The basis of the calculations are upper limits of tolerable deceleration which are a function of impact duration. Two types of lap and shoulder restraint schemes for achieving optimal restraint conditions are described. The method of strapping the passenger to the seat and permitting the seat to slide forward seems to be the best approach, since restraint in all directions is ensured throughout the duration of the impact. By incorporating inflatable type belts and straps, the contact pressures can be minimized. A totally passive hydraulic/pneumatic shock isolation system for constraining the deceleration levels to acceptable and approximately constant values (controlling the slippage of restraint systems) is described. Typical results of digital computer simulation studies demonstrate the significance of energy dissipation by means of structural deformation of the vehicle. Also the simulation results demonstrate that the passive shock isolation system can be utilized to achieve an approximately constant and safe deceleration.

by Leslie O. Wilkins; David A. Hullender
Publ: High Speed Ground Transportation Journal v9 n1 p425-433 (Spring 1975)
1975; 16refs
Sponsored by the Graduate Organized Res. Prog., Univ. of Texas at Arlington.
Availability: See publication

HS-017 555

MEASURED ILLUMINATION CHARACTERISTICS OF THE 1974 HEADLAMPS. PART 1. THE S.A.E. HEADLAMPS

Fifty-five different SAE 5 3/4 inch 1974 headlamps were measured for illumination values over a spherical surface 60 ft from the lamp in a photometric laboratory to produce a m

mination readings and transmit the data to a recorder. The complete illumination dataset was stored on magnetic tape for future reference. The intensity map form of the measured illumination data is described in detail. Tables of the range of intensity map values for the various headlamps are provided and contour plots of the intensity maps for the different groups of headlamps have been collected for future reference.

by Ann L. Harrison
National Res. Council Canada, National Aeronautical Establishment, Ottawa, Canada
Rept. No. LTR-ST-783 ; 1975 ; 183p 6refs
Availability: Corporate author

HS-017 556

THREE-DIMENSIONAL HUMAN DISPLAY MODEL

A two-dimensional computer graphic display of a three-dimensional human being is presented. The major body segments of the model are represented as non-uniform elliptic cylinders. The shadow outlines of these cylinders are displayed on the terminal screen and connected by circular arcs and straight lines to produce a realistic representation of a human being in any position. The human model was developed for the display of results of three-dimensional simulation programs which calculate the position of an occupant during vehicle impact. However, it is well suited to any other type of human motion. It allows the user to select the viewing orientation and was designed for low cost computer and graphic terminal systems.

by Tom E. Potter; Kenneth D. Willmert
Clarkson Coll. of Tech., Potsdam, N.Y. 13676
Contract N00014-70-A-0311-0003
Rept. No. MIE-010; AD-A011097 ; 1975 ; 47p 4refs
Rept. for Feb 1974-Jul 1975.
Availability: NTIS

HS-017 557

1975 MOTOR TRUCK FACTS

Assorted statistical information on trucks (through 1975) is presented. The following trends of recent years are reported: United States (U.S.) retail sales of new trucks; energy-saving developments of new trucks; emissions reductions (1966 to 1973); noise sources and abatements; fatality rates per 100 million vehicle miles on the interstate system (by vehicle responsible, 1968 and 1969-1971); truck and bus factory sales by body types and weight (1974) and by body type alone (1968-1974); U.S. and Canada truck and bus production (1972-1974); U.S. truck assemblies by states and factory installed equipment (1973 and 1974); shipments by manufacturers of truck, bus and other vehicle bodies (1967 and 1972); truck trailer output by type (1966-1973); new truck registrations (1969-1974); motor vehicle registrations by states (1973/1974); truck registrations by states (1972-1974); regional distribution of truck registrations; and 1973 world truck and bus registrations. Also reported are: world truck and bus production (1972 and 1973); truck registrations in 16 selected counties (1974); commodities shipped by mode of transport; small plant shipment by transport mode; intercity shipments of motor vehicles and equipment by mode (1972); freight transport revenues by mode (1969-1973); school bus usage and ownership by states (1972/1973); farm ownership of motor vehicles; light trucks in use (1972); characteristics of trucks owned; major use of

U.S. truck and bus imports (1971-1974) and exports (1974); annual state sales and federal taxes per vehicle; state highway user taxes paid by trucks (1973); and highway trust fund receipts. Included are statistics from the last 10-15 years: truck and bus record sales and production years; factory sales of diesel trucks by weight (1962-1974); U.S. factory sales of special bus types (1965-1974); recreational vehicle shipments (1961-1974); truck registrations by model year (1963-1974); and comparison between combination and single unit trucks (1964-1973). Some of the statistical information covers 20 or more years: annual factory sales of trucks and buses in U.S. (1945-1974); truck and bus tire shipments (1950-1974); U.S. truck and bus registrations (1900-1974); world registrations (1925-1973); intercity freight movement by mode (1950-1974); and special state and federal truck taxes (1930-1974).

Motor Vehicle Mfgs. Assoc. of the United States, Inc.,
Statistics Dept., 320 New Center Bldg., Detroit, Mich. 48202
1975 ; 65p
Availability: Corporate author

HS-017 558

THE NEW AIR BRAKE SYSTEMS--AN IMPACT OVERVIEW

The impact of Federal Motor Vehicle Safety Standard 121 (FMVSS 121), the new air brake standard for heavy-duty trucks, is discussed. FMVSS 121 will force most old brake system components to be modified and wheels, hubs, steering knuckles, axles, suspensions, frames, and cab mounts will also have to be altered. Maintenance problems and safety and other benefits brought about by FMVSS 121 are examined. Diagrams are provided showing the complexity of the new air brake system as compared to the old system (the new system has nearly twice as many components). Numerous problems with the new systems remain and will not be solved until large numbers of trucks equipped with them are on the road.

by Michael J. Denholm
Publ: Commercial Car Journal v128 p71-75 (Jan 1975)
1975
Availability: See publication

HS-017 559

TRAFFIC SAFETY. PROCEEDINGS OF THE SCIENTIFIC CONFERENCE, OTTAWA, ONTARIO, CANADA, MAY 23 AND 24, 1974

Various factors in traffic safety were evaluated: the influence of alcohol and drugs on traffic safety; behavior, psychological and social factors; seat belts; motorcycle safety; and emergency medical care. The following specific topics are discussed: an experimental evaluation of a community based campaign for the prevention of drunk driving in Ontario; drugs and driving; alcohol involvement in fatal and non-fatal crashes; driver-road sign interaction; driver performance related to the vehicle; methods of measuring driver behavior; the seat belt argument; and the effect of the compulsory seat belt wearing law in Australia. Also discussed are: motorcycle accident injuries; the protective value of motorcycle helmets; motorcycle training; an evaluation methodology for emergency medical services; and quality measurement of emergency medical care. A panel discussion of the problems, progress and goals of traffic safety is also provided.

Traffic Injury Res. Foundation of Canada; Canadian Dept. of National Health and Welfare; Canada Ministry of Transport 1974 : 212p refs
Includes HS-017 560--HS-017 573.
Availability: Corporate author

HS-017 560

COUNTERMEASURES--A COMMUNITY BASED CAMPAIGN FOR THE PREVENTION OF DRUNK DRIVING: AN EXPERIMENTAL EVALUATION

The organization of publicity campaigns to become more effective parts of a comprehensive drunken driving countermeasure program is described. The campaigns stressed community involvement and action. A group of target cities and a group of matched cities in Ontario were selected, as part of a pilot effort, for publicity campaigns utilizing the various media and special publicized events (such as a drink-in breathalyzer party). Before and after telephone interview surveys were conducted in the 18 cities involved for 2,000 randomly selected drivers. It was found that: about 43% of the subjects in the target cities recalled a recognizable message from the campaign; the proportion recognizing jail sentencing as a possible penalty increased from 74 to 80% in the target cities, with no change in the control cities; two-thirds of those interviewed favored tougher penalties for drunken driving in both before and after surveys; in all surveys about 53% favored the expenditure of more enforcement resources against drunken drivers; 54% thought police should be able to stop anyone and require a breathalyzer test on the spot; and the proportion of those saying they avoided driving after drinking too much went from 4% to 8% in the target cities.

by Lawrence P. Lonerio
Ontario Ministry of Transportation and Communications,
Downsview, Ont., Canada
Publ: HS-017 559, Scientific Conference on Traffic Safety.
Proceedings, Ottawa, Canada, 1974, p1-7
1974
Availability: In HS-017 559

HS-017 561

DRUGS (OTHER THAN ALCOHOL) AND DRIVING

The application of an ecological model to the subject of drugs (other than alcohol) and driving to evaluate and manipulate the interacting influences of person, substance or vehicle, and environment is discussed. The medical uses of drugs are considered: drugs that may make a person unfit for driving; and drugs used as prescribed (sedatives, tranquilizers and anti-depressants, antihistamines and motion sickness drugs, central nervous system stimulants, anti-infective agents, and anticonvulsants). Also the non-medical uses of drugs are discussed: marijuana, sedatives and tranquilizers, amphetamines, and other drugs. General problems of drug use and driving are considered and an outline of possible elements for a comprehensive program to deal with the problems is offered. Recommended first steps are: one or more Canadian studies to determine the levels of drugs in body fluids of motor vehicle crash victims; the addition of questions on drug use to roadside surveys of alcohol use; and efforts to obtain more information about drug use in cases of impaired driving.

by H. N. Colburn; B. H. Garland
Department of National Health and Welfare, Ottawa, Ont., Canada
Publ: HS-017 559, Scientific Conference on Traffic Safety.
Proceedings, Ottawa, Canada, 1974, p8-20A
1974 : 13refs
Availability: In HS-017 559

HS-017 562

COMMENTS ON ALCOHOL INVOLVEMENT IN FATAL AND NON-FATAL CRASHES

A short discussion of alcohol involvement in automobile accidents is presented. The overemphasis of alcohol as a causal factor is considered and other contributing factors to accidents are pointed out: driver's feelings and attitudes, poor vision, age and experience, road and weather conditions, time of day, sickness and diseases, and socio-economic and cultural factors. It is concluded that one cannot direct countermeasure efforts at drinkers in general if it is not drinkers in general who comprise the problem.

by Richard Zylman
Rutgers Univ., Center of Alcohol Studies, New Brunswick, N.J.
Publ: HS-017 559, Scientific Conference on Traffic Safety.
Proceedings, Ottawa, Canada, 1974, p21-4
1974
Availability: In HS-017 559

HS-017 563

DRIVER ROAD SIGN INTERACTION

The complex problem of informing, guiding, and warning the motorist on today's crowded streets and highways is discussed. The major difficulties with current traffic signs are identified: misinformation, missing information, and inextricable information. Symbols, either pictographs or abstract designs, are pointed out as perhaps the most widespread example of confusing traffic sign information. It is suggested that near accidents rather than accidents be examined to evaluate traffic signs. The meaning of traffic signs has been shown to be unknown to a large proportion of drivers.

by Robert E. Dewar
University of Calgary, Dept. of Psychology, Calgary, Alta., Canada
Publ: HS-017 559, Scientific Conference on Traffic Safety.
Proceedings, Ottawa, Canada, 1974, p 25-7
1974
Availability: In HS-017 559

HS-017 564

DRIVER PERFORMANCE RELATED TO THE VEHICLE

The effects of the vehicle on driving performance are discussed in terms of anthropometry, visibility, control design, workplace, layout, and environment. Solutions to the problem of improving driver performance are offered (improved controls, displays, and vehicle design). It is concluded that advances in vehicle safety and performance have increased the driver's chances of staying out of accidents on modern high density, high speed road systems, but many improvements in

by Dennis A. Attwood
Ministry of Transport, Road Safety Unit, Downsview, Ont., Canada
Publ: HS-017 559, Scientific Conference on Traffic Safety.
Proceedings, Ottawa, Canada, 1974, p28-37
1974 ; 30refs
Availability: In HS-017 559

HS-017 565

METHODS OF MEASURING DRIVER BEHAVIOUR [BEHAVIOR]

Various methods of measuring driver behavior are briefly discussed and suggestions are made. The driving environment, driver's perception, and driver's decision making must be considered. It is concluded that: since driver behavior is very complex, multi-variable recording techniques are necessary; whenever possible the driver (subject of test) should be in a vehicle with which he is familiar and experiments should be conducted in real traffic situations; and concentrating on how the driver perceives his world is a worthwhile venture which should contribute toward a more satisfactory understanding of accidents caused by driver error.

by David J. Hieatt
Ontario Ministry of Transportation and Communications,
Downsview, Ont., Canada
Publ: HS-017 559, Scientific Conference on Traffic Safety.
Proceedings, Ottawa, Canada, 1974, p38-43
1974
Availability: In HS-017 559

HS-017 566

THE SEAT BELT ARGUMENT

A review of current seat belt related information and a summary of the most pertinent recent findings with respect to seat belt effectiveness, seat belt usage, and approaches to increasing seat belt wearing is presented. Public education and mechanical methods (buzzer or light warning) of encouraging seat belt usage are discussed. Seat belt usage laws (mandatory usage in Australia) are considered. Other countries that have recently passed seat belt usage laws are: New Zealand, France, Spain, Israel, Czechoslovakia, and Puerto Rico. The main issues concerning seat belt usage laws are discussed: public education to inform people of the law, its benefits, and the benefits of seat belts; ensuring convenience of belts (preferably three-point belt, easily-adjustable, and non-tangling); enforcement (if handled correctly, enforcement could be slight and penalties small); the argument that mandatory belt usage laws are an infringement on individual rights; the effect of non-use on injury compensation; and the substance of the seat belt wearing law (persons and vehicles to be affected, exemptions for certain types of machinery, type of acceptable belts; and compulsory fitting of belts). An annotated bibliography is included.

by M. J. Taylor
Ministry of Transport, Road and Motor Vehicle Traffic
Safety, Ottawa, Ont., Canada
Publ: HS-017 559, Scientific Conference on Traffic Safety.
Proceedings, Ottawa, Canada, 1974, p48-71
1974 ; refs
Availability: In HS-017 559

HS-017 567

THE INTRODUCTION OF COMPULSORY SEAT BELT WEARING LAWS IN AUSTRALIA AND THEIR EFFECT

Australian compulsory seat belt wearing laws and their effects on seat belt wearing rates, deaths and injuries, and injury patterns are discussed. Efforts made to alter the incorrect seat belt wearing habits of many drivers in Australia are reported. The enforcement of seat belt wearing is considered: a maximum penalty of \$20 is given for non-wearing; public support has been widespread; and police have not found enforcement difficult. In addition to incorrect wearing habits, the problem of drunken drivers not wearing the seat belts is mentioned. It is concluded that compulsory seat belt wearing legislation has: raised seat belt wearing rates to the highest levels in the world; and decreased the number of vehicle occupant deaths and injuries in Australia. Seat belt usage is now regarded as normal behavior in Australia.

by R. Ungers
Australian Dept. of Transport, Road Safety Res. Sec.
Publ: HS-017 559, Scientific Conference on Traffic Safety.
Proceedings, Ottawa, Canada, 1974, p72-89
1974 ; 9refs
Availability: In HS-017 559

HS-017 568

INJURIES OCCURRING IN MOTORCYCLE ACCIDENTS

A study conducted in the summer of 1973 in Ottawa, Canada of motorcycle accident injuries is reported. Accident investigators gathered accident data and photographs at the scene, and medical data after the victim was hospitalized. A total 133 injured persons (108 drivers and 25 passengers, 16 of whom were female) were involved. The 16-25 age group was found the most vulnerable. Lack of training and inexperience played a role in 35 of the cases and in only 6 of the accident injuries were drugs or alcohol a factor. In 52 of the accidents, victims were ejected; in 61, victims were not ejected; and in 21, victims suffered some type of deflection injury. Most commonly, victims struck the road, and 60%-70% of the accidents were due to car collisions. Injuries to the head and the upper and lower extremities and the conditions that brought them about are briefly discussed. Injury regions were: 68 cases of injury to the lower extremity, 57 to the upper extremity, and 41 to the head and face. It is concluded that: proper instruction in both the handling and the maintenance of the machine should be mandatory; leather clothing is essential; and automobile drivers should be made more aware of motorcyclists through public education. Recommendations are made for the use of: crash bars, reflector tape, rear view mirrors, protective covering for engine and handlebars, air bags, and tightened front suspension.

by D. H. Johnson
Publ: HS-017 559, Scientific Conference on Traffic Safety.
Proceedings, Ottawa, Canada, 1974, p97-100
1974
Availability: In HS-017 559

HS-017 569

THE PROTECTIVE VALUE OF CONTEMPORARY MOTORCYCLE HELMETS IN THE PREVENTION OF HEAD INJURIES

An investigation of the effectiveness of contemporary motorcycle helmets and the Canadian safety standard applying to them (CSA D230-1970) is reported. A team of investigators, all trained motorcyclists, gathered data from the police, witnesses, and the victim at the sites of 132 motorcycle accidents. Photographs were taken of the site and medical reports were examined. In relation to head impacts the following accident factors were studied: the type of helmet used and its certification; the location of the blow on the helmet; the nature of the object striking the helmet; the blow severity; the direction of the blow; helmet retention; and facial and neck injuries. It is concluded that: contemporary motorcycle crash helmets are fairly effective in the reduction of head injuries (nearly 40% of all accident victims would have received head injuries had helmets not been used; only 15% suffered head injury following helmet impact); helmets provide inadequate facial protection even with face shields; helmets that are CSA D230 certified appear to offer the greatest protection; and helmets are not penetratable by objects normally encountered in motorcycle accidents. It is also concluded that: injuries to the head and face comprise 20% of all motorcycle injuries; facial injuries were sustained by 15% of all victims; closed injuries are the most frequent head injury (minor concussions are most prevalent); the extent of protection defined in CSA-D230 is inadequate and poorly defined; the prescribed impact test level appears to be adequate; chin strap release is inadequate; helmets need not be impacted more than once at the same site but impact shapes other than flat should be used in testing; glancing blows should be considered in the standard test procedure; and current penetration tests are inadequate.

by James A. Newman
University of Ottawa, Dept. of Mechanical Engineering,
Ottawa, Ont., Canada
Publ: HS-017 559, Scientific Conference on Traffic Safety.
Proceedings, Ottawa, Canada, 1974, p101-114J
1974; 26p 9refs

This is an interim report of an investigation conducted by the Motorcycle Crash Investigation Unit of the Univ. of Ottawa, supported by the Traffic Injury Res. Foundation, the Federal Dept. of National Health and Welfare, and the Ministry of Transport.

Availability: In HS-017 559

HS-017 570

MOTORCYCLE TRAINING--STANDARDS FOR SURVIVAL

Trends in motorcycle accidents are reviewed, techniques for avoiding collision are submitted, and the incorporation of these techniques in Canadian motorcycle training courses is reported. The death rate for motorcyclists is 20 per 100 million miles traveled in the United States as compared to 4.7 per 100 million miles for all vehicles. Age, experience and skill factors in motorcycle accidents are discussed. The Canadian motorcycle training courses involve all levels of government in Canada and include: provincial motor vehicle agencies, safety organizations, educational authorities, Canadian Motorcycle Association affiliated clubs and local police departments. Course requirements include: starting, stopping and planning a motor

and starting on hills; emergency braking; riding in traffic; passenger carriage; obstacle negotiation; out-tracking; and advance handling on adverse surfaces and broadsliding. It is concluded that: students should also be required to study traffic regulations, signs and signals, mechanical and electronic theory, providing safety checks, trouble shooting, basic weekly maintenance, sensible clothing and protective equipment, and defensive driving; and students must be thoroughly indoctrinated in methods of collision avoidance and trained taking fast and effective corrective action. Factors affecting the establishment of training, the selection of instructors, course syllabus and a final test are appended.

by Stuart Munro
Ministry of Transport, Road and Motor Vehicle Traffic Safety, Ottawa, Canada
Publ: HS-017 559, Scientific Conference on Traffic Safety. Proceedings, Ottawa, Canada, 1974, p115-35
1974; 9refs
Availability: In HS-017 559

HS-017 571

AN EVALUATION METHODOLOGY FOR EMERGENCY MEDICAL SERVICES

An evaluation methodology for emergency medical services (EMS) is discussed: the background; the method of testing and refining the methodology itself; how it was used in actual application; and the current status and plan for implementation of this assessment model by various states in the United States and countries in Western Europe. Evaluative EMS data collection is divided into phases: pre-survey data collection field survey; and post-survey data collection. It is concluded that application of the evaluation methodology will provide the first step for communities, states, and nations to identify the most cost-beneficial ways of increasing the efficiency and effectiveness of their systems.

by William R. Gemma
Air Force Office of the Surgeon General, Washington, D.C.
Publ: HS-017 559, Scientific Conference on Traffic Safety. Proceedings, Ottawa, Canada, 1974, p141-9
1974
Availability: In HS-017 559

HS-017 572

QUALITY MEASUREMENT OF EMERGENCY MEDICAL CARE

A plan for a quality measurement study of emergency medical services (EMS) in a region 200 x 35 miles with a population about 500,000 is discussed. Specific questions to be answered are outlined and the sources of information for the study (the ambulance service, the hospitals, the coroners' reports, and the provincial audit) are considered. A total of 100 motor vehicle accidents are to be observed and an appraisal is to be given to each incident of patient care. In addition, information will be gathered from hospital case records (2,000 cases major and minor emergency cases, and coroners' studies. It is reported that most preliminary work has been done and the study is ready to begin.

Care Study, Ottawa, Canada.
Publ: HS-017 559. Scientific Conference on Traffic Safety.
Proceedings, Ottawa, Canada, 1974, p150-553
1974 ; 16p
Availability: In HS-017 559

HS-017 573

PROBLEMS, PROGRESS AND GOALS IN TRAFFIC SAFETY [PANEL DISCUSSION]

The following aspects of traffic safety in Canada are briefly discussed: the traffic safety problem (fatalities, trends, and expenditures); traffic safety objectives; and the traffic safety programme. The following accident countermeasures are offered: increase seat belt use; reduce alcohol impaired driving; correct hazardous road locations; more safety standards for new trucks, buses, and school buses; improved vehicle maintenance; extension and improvement of driver education; and increased police presence. The following statistics are presented: Canadian 1971 transportation fatalities (categorized); motor vehicle fatalities, 1950-1975 (graph); fatalities per 100 million vehicles miles, 1950-1975 (graph); comparison of vehicle fatality rates for Canada, the United States, Britain, and France; and Canadian motor vehicle fatalities, 1950-1977 (graph).

by Gordon D. Campbell, moderator
Publ: HS-017 559, Scientific Conference on Traffic Safety.
Proceedings, Ottawa, Canada, 1974, p156-74
1974 ; 28p
Availability: In HS-017 559

HS-017 574

DESIGN AND IMPLEMENTATION OF A SYSTEM TO RECORD DRIVER LATERAL POSITIONING

Previous attempts to measure vehicular steering or tracking accuracy are reviewed and criteria are specified for an optimal tracking system design. The system should: operate over existing roads, not affect driving behavior, be accurate, operate over a range of illumination levels, have a high and favorable measurement rate, have no moving parts, provide for simple data recording and reduction, be inexpensive, provide for simultaneous event recording, and be transferrable among vehicles. These criteria were used to develop a novel photooptic system that mounts on a test vehicle and continuously records lateral lane positions. A photodiode array is used to detect the position of the vehicle relative to the shoulder line. System design (circuit description, optical system, and mechanical design), data reduction procedures, and practical implementation considerations are discussed. System performance was demonstrated by recording driver tracking performance over shallow right and left curves (10 subjects drove a Ford Custom 500 sedan over a 0.28 mile curve on a 2-lane rural asphalt road at 55 mph). The system was found sensitive to the differences in driving behavior on the two curves. The device is presented as a flexible, reliable, and accurate instrument for recording vehicular tracking.

by James A. Gardner; Stanley M. Soliday; Glen A. Williamson
Publ: Transportation Research Record n538 p59-68 (1975)
1975 ; 14refs
Supported by the North Carolina State Univ.
Availability: See publication

EFFECT OF 55-MPH SPEED LIMIT ON AVERAGE SPEEDS OF FREE-FLOWING AUTOMOBILES ON AN INTERSTATE BRIDGE IN WEST VIRGINIA

Data on average speeds of free-flowing automobiles were collected from a study of vehicle speed and placement on an Interstate bridge in West Virginia. Data were collected in the summers of 1973 (851 vehicles) and 1974 (245 vehicles) and mean speeds for each summer were compared to determine whether the nationwide speed limit of 55 mph had any effect. It was found that mean speed declined from 61.0 mph in 1973 to 54.5 mph in 1974. The standard deviation of the distribution also declined from 9.2 mph to 6.0 mph, thus providing another possible explanation for the reduction in automobile accidents.

by Bernard F. Byrne; Robert R. Roberts
Publ: Transportation Research Record n538 p69-74 (1975)
1975 ; 2refs

Part of a report prepared for the West Virginia Dept. of Hwys. in cooperation with the Federal Hwy. Administration.
Availability: See publication

HS-017 576

THE STRUGGLE OVER WHAT'S UP FRONT [THE ARGUMENT ABOUT FRONT AXLE WEIGHT MAXIMUM]

The ongoing controversy over the weight limitations for front axles on trucks is discussed. The role of Congressional Representative Edward Koch of New York and his bill limiting gross trucking weight to 73,280 pounds and front axles to 10,000 pounds (supported by the American Automobile Association and the Professional Drivers Council for Safety and Health) and the opposition from the trucking industry is discussed. The statistics and strategy used by both sides are considered. Many drivers do find the 12,000 pound steering axle advocated by many difficult to handle. The questions of tire strength under the great weight and the matching of cab and equipment to axle weight are discussed. It is concluded that the most important need is research, detailed and unhampered by any predetermined conclusions.

by Bernie Swart
Publ: Fleet Owner p66-71 (Sep 1975)
1975 ; 6p
Availability: See publication

HS-017 577

SPEED CONTROL IN RURAL SCHOOL ZONES

Initial results are presented of a comprehensive experiment dealing with speed control in a rural school zone on a high-speed, two-lane highway. Data were collected in a school zone on an electronically instrumented Maine roadway where a 15 mph speed limit is in effect during certain times of the school day. The effect on drivers of official mandatory and advisory school zone signs, including beacon flashers, and the effect of a new, dynamic speed violation sign were determined. Speeds for automobiles and large vehicles were measured for one dynamic and four passive sign conditions (existing school signing, mandatory school sign and the permitted speed limit sign with beacons, an advisory advance school zone sign, an advisory sign with beacons, and a speed violation sign with

beacons) when the 15 mph speed limit both was and was not in effect. No enforcement was used during the experiment. Results showed that: vehicle velocities were less at the school when the driver was advised by flashing beacons than the 15 mph speed limit was in effect; the average vehicle velocity was relatively constant at the schools when the speed limit was not in effect; and the lowest average speeds at the school (34 mph) were obtained when the dynamic speed violation sign was used.

by Merton J. Rosenbaum; Phyllis Young; Stanley R. Byington; William Basham
 Publ: Transportation Research Record n541 p12-25 (1975)
 1975 ; 4refs
 Availability: See publication

HS-017 578

RELATIONSHIPS BETWEEN ROADWAY GEOMETRICS AND ACCIDENTS

Statewide average and critical rates of accidents were determined from 1970, 1971, and 1972 Kentucky accident records for each type of rural highway (two-lane, three-lane, four-lane undivided, four-lane divided, and interstate and parkway). Accident data, obtained from state police computer tapes, were summarized to give the number of accidents on each highway type as well as information on accident severity, road surface conditions, light conditions, road character, and type of traffic control. Four-lane undivided highways had the highest average accident rate, and parkways (toll roads) had the lowest rate. The severity of accidents was related to types of accidents, highways, traffic control, and safety belt use. Accidents involving pedestrians were the most severe, and single-vehicle accidents ranked next highest in severity. Excluding accidents at railroad crossings, accidents that occurred on curves had the highest severity index. The use of seat belts was associated with reduced severity.

by Kenneth R. Agent; Robert C. Deen
 Publ: Transportation Research Record n541 1-11 (1975)
 1975 ; 6refs
 Availability: See publication

HS-017 579

AUTOMOTIVE SOLID STATE DISPLAYS

Automotive solid state displays are discussed with emphasis on field effect liquid crystals and electroluminescence. Evaluation of a prototype form on an automobile is to take place soon. The advantages of solid state displays are considered: size (much shallower than conventional instrument panels); reliability (no moving parts, fewer components, less chance of substandard performance); and versatility (parameters to be shown can be arranged in any desired configuration without the necessity for new or different basic parts). A comprehensive car instrument package has been developed which can display the following functions: road speed, total mileage and trip mileage, engine revolutions, fuel contents, battery voltage, coolant temperature, oil pressure, and time. It can also give warning light indication of: low oil pressure, low coolant, no charge, low brake fluid, lamp failure, exhaust gas recirculation or catalyst, high beam, rear glass heater on, rear fog light, low fuel, and direction indicators. It is practical, with the present

by W. W. Bischoff
 Publ: Journal of Automotive Engineering v61 n6-9 (Feb 1975)
 1975
 Availability: See publication

HS-017 580

HIGHLY TURBOCHARGED SMALL AUTOMOTIVE DIESEL ENGINES

The development of the turbocharging of a small automotive four-stroke four-cylinder diesel engine capable of reaching about 20 horsepower naturally aspirated so that it can reach up to 2 1/2 to 3 times that power when required is discussed. The economic advantages of such a diesel (primarily in fuel savings) are considered. The system description and operation and the design considerations (for the combustion chamber, fuel injection, valves, pistons, cooling, cylinder liners, bearings, oil sump, and gear box) are examined. The advantages in fuel savings of small diesel engines more than compensate for their higher capital costs.

by M. S. Radwan; N. D. C. Tee
 Publ: Journal of Automotive Engineering v6 n2 p17-22 (Apr 1975)
 1975 ; 15refs
 Availability: See publication

HS-017 581

MOTION RESISTANCE OF PNEUMATIC TYRES [TIRES]

A general engineering solution for the rolling resistance of pneumatic tires, from hard pavements to the soft surface of a yielding ground, is developed. Tire flexing motion resistance, and tire, road, and terrain data input are examined. The method of parametric evaluation of tires on a rigid road and in soft ground is discussed and the nature of trade-offs that can be made in optimization of the energy spent on tire propulsion under specific road conditions is illustrated.

by M. G. Bekker; E. V. Semonin
 Publ: Journal of Automotive Engineering v6 n2 p6-10 (Apr 1975)
 1975 ; 14refs
 Availability: See publication

HS-017 582

EMISSIONS AND ECONOMY OF FOUR DIESEL CARS

Four diesel-powered passenger cars (a 1972 Mercedes-Benz 200D, a 1973 Peugeot 504D, an Opel Rekord 2100D, and a Nissan diesel-powered Datsun) were subjected to a wide variety of emission and economic evaluations. Tailpipe emissions were measured by the 1975 Light Duty Federal Test Procedure for gaseous emissions, fuel economy (carbon balance and gravimetric) and smoke. Smoke and gaseous emissions were also measured by chassis dynamometer versions of the 1974 Federal heavy-duty procedures. Odor and related instrumental-chemical measurements were made under seven steady-state and three transient conditions and a liquid chromatograph, in-

were taken during driveby tests (at 50 feet and 30 mph), interior tests (microphone 6 inches from driver's ear) and exterior idle tests (at 10 feet from car at low idle speed). It was found that: the low emission capability of diesel cars was confirmed (hydrocarbons and carbon monoxide, except for the Peugeot, were both less than 1977-1978 Federal limits); fuel economy or gas mileage fell within the range of 24.9-28.5 miles per gallon for all cars; hydrocarbons from the Peugeot were about ten times greater than that of the other three cars; the Peugeot had exhaust odor intensity much higher than the other vehicles; the Mercedes and the Peugeot emitted the least amount of smoke; and diesel cars do not have to be noisy.

by Karl J. Springer; Ralph C. Stahman
Southwest Res. Inst.; Environmental Protection Agency
Contract Ref. EPA-PH-22-68-23
Rept. No. SAE-750332; 1975; 20p 18refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-017 583

THE TEXACO IGNITION SYSTEM--A NEW CONCEPT FOR AUTOMOTIVE ENGINES

The Texaco Ignition System (TTIS), a high frequency system with a bi-directional spark current, the duration of which is a function of crankshaft rotation rather than time, is described. The spark current characteristics (controlled spark duration) differ drastically from those of conventional discharge systems and, as a result, current flow through the plug gap can be maintained under extremely turbulent conditions. Being essentially a constant current device, it prevents excessive plug current flow during initial gap ionization, providing a good plug life; yet it has high average current to increase fuel ignition probability. The system, developed primarily for use with stratified charge engines, has also been shown to have characteristics which improve the performance of premixed charge engines operated under severe conditions, in order to reduce exhaust emissions, improve drivability, and increase fuel economy. TTIS is of solid state design, and both the spark timing and spark duration are controlled by use of digital logic circuitry.

by R. E. Canup
Texaco Inc.
Rept. No. SAE-750347; 1975; 12p 4refs
Presented at the Automotive Engineering Congress and
Exposition, Detroit, Mich., 24-28 Feb 1975.
Availability: SAE

HS-801 659

SURVEY OF SAFETY RELATED CONDITIONS IN SCHOOL BUSES. FINAL REPORT

A nationwide sample of school bus operators is surveyed in order to identify and document conditions having an impact on the safe operation of the buses and not appearing to be the result of inadequate or inappropriate maintenance procedures, abusive operation, or normal wear. A total of 100 school bus operators in 10 geographically dispersed areas of the United States were selected for participation in the field survey. Fleet personnel were interviewed regarding safety-related mechanical conditions their buses had experienced. Maintenance records and photographs of failed components were reviewed

interviewed. Detailed descriptions of selected conditions judged to be significant are provided: single manufacturer chassis conditions (Chevrolet/General Motors Corporation (GMC) steering, Dodge fuel system, steering, and hood assembly, Ford suspension, throttle linkage, battery and alternator wiring, and motor support cross member, GMC power steering fluid reservoir, and transmission); multiple Harvester steering, suspension, brakes, engine, gas tank support straps, tail pipe hangers, and transmission); multiple manufacturer chassis and body conditions (flashing loading light system, power steering lines and hoses, air brake lines and hoses, windshield wiper subsystem, stop arms, air-operated service door, emergency door handle, electrical wiring system, and exhaust system); and human factors conditions. Two basic types of school bus operation were included in the survey: those run by the school system, and those run by a private contractor. It was found that as fleet size increases, records and record-keeping procedures tend to get better, rankings of operator quality increase, and the ability of the operator's personnel to recall individual buses with a specified condition decreases.

by Richard L. Dueker; Richard M. Thackray, Jr.
Applied Science Assocs., Inc., Box 158, Valencia, Pa. 16059
Contract DOT-HS-4-00947
Rept. No. ASA-367; 1975; 218p
Rept. for 25 Jun 1974-18 Jun 1975.
Availability: NTIS

HS-801 662

MOTOR VEHICLE SAFETY DEFECT RECALL CAMPAIGNS--DETAILED REPORTS FROM APRIL 1 TO JUNE 30, 1975

Letters of notification and other communications to dealers and their customers, relative to defect recall campaigns in the second quarter of 1975, produced by domestic and foreign manufacturers are presented without commentary.

National Hwy. Traffic Safety Administration, Washington, D. C. 20590
1975; 781p
Availability: NTIS

HS-801 663

STANDARDS ENFORCEMENT TEST REPORTS INDEX FOR 1973

The index to Standards Enforcement test reports of the National Highway Traffic Safety Administration for calendar year 1973 is presented. Contents include manufacturers; model year; model or part number; whether it passed or failed; standard number; component or vehicle identification number; laboratory test report number; CIR number; fiscal year of test program; highway safety number; brand or seller; and tire size or body style.

Kappa Systems, Inc., 1501 Wilson Blvd., Arlington, Va. 22209
Contract NHTSA-5-1673
1975; 1749p
Sponsored by the National Hwy. Traffic Safety Administration. See also index for 1969 (reference copy only), index for 1970 (PB-200 309), index for 1971 (PB-210 436), and index for 1972 (PB-221 350).
Availability: NTIS

HS-801 699

TRAFFIC SAFETY '74. A REPORT ON ACTIVITIES UNDER THE HIGHWAY SAFETY ACT OF 1966

Activities stemming from the Highway Safety Act of 1966 include investigations into: pedestrian and bicycle safety; alcohol, drugs and traffic safety; improvements in driver education and licensing; traffic law enforcement; motor vehicle inspection programs; inspection standards and diagnostic inspection; highway environment and engineering; curb ramps for the handicapped; survival during and after the crash including safety belt usage and military assistance to safety and traffic; special programs for international cooperation, technical training, data acquisition, analysis and reporting; and the use of research and problems addressed by current grants. National Highway Safety Advisory Committee, the Youth Highway Safety Advisory Committee, and the NHTSA consumer services are reported upon, as well as the reorganization of NHTSA. Appendices list funding tables; current research grants and contracts; publications of the NHTSA; and statistical compilation of motor vehicle and vehicle usage facts, including: vehicle mileage versus death rate; fatalities by state for 1974; motorcycle and bike fatalities; fatalities by day of week, month, registration, highway system, age, sex; and distribution of driver licenses. Litigation for calendar year 1974 is noted.

National Hwy. Traffic Safety Administration, Washington, D.C.

1975 ; 171p refs

Rept. for 1 Jan-31 Dec 1974.

Availability: Corporate author

HS-801 700

TRAFFIC SAFETY '74. A REPORT ON ACTIVITIES UNDER THE NATIONAL TRAFFIC AND MOTOR VEHICLE SAFETY ACT OF 1966 AND THE MOTOR VEHICLE INFORMATION AND COST SAVINGS ACT OF 1972.

A report on the activities under the National Traffic and Motor Vehicle Safety Acts of 1966 for 1974 includes: motor vehicle safety; energy crisis; management by objectives; standards and litigation; special programs for international cooperation, data acquisition, analysis and reporting, research safety vehicle bumper standards and consumer information; crash survivability including occupant protection, pedestrian protection, biomechanics and vehicle structures; crash avoidance, including vehicle handling, tires and wheels, brakes, and the driver and his vehicle; defects investigation including the significant cases investigated in 1974, resulting in recalls, and enlargement of NHTSA's purview regarding safety defects; enforcement, including certification and penalty actions; and a report on NHTSA's interim engineering facility. The activities of the National Motor Vehicle Safety Advisory Council and the NHTSA consumer services are reviewed, and the NHTSA reorganization outlined. Appendices present a statistical compilation for 1974 listing: vehicle mileage versus death rate; fatalities by state; motorcycle and bike fatalities; fatalities by day of week, month, registration, age and sex; and distribution of drivers licenses; as well as charts of funding tables; contracts and grants; and publications

National Hwy. Traffic Safety Administration, Washington, D.C.

1975 ; 164p refs

Rept. for 1 Jan-31 Dec 1974.

Availability: Corporate author

HS-801 702

EFFECTS OF INTERMIXING OF BIAS, BIAS BELTED, AND RADIAL PLY PASSENGER TIRES ON VEHICLE DYNAMICS AND DRIVER/VEHICLE RESPONSES. FINAL REPORT

A field test program aimed at quantitatively determining the changes in vehicle dynamics and driver response characteristics when radial, bias belted, bias ply and lower pressure radial tire sets are intermixed on the front and rear of passenger cars is described. Driving tasks included highway lane tracking in the presence of simulated crosswind disturbances, transient tasks such as normal and emergency lane changes, and limit of control tasks such as a high-speed slalom. Three male test drivers were used: one experienced race driver and two ordinary drivers. All were unaware of the conditions being tested although they were aware of the overall nature of the program. Results showed that radial fronts with belted rears produced the greatest reduction in base vehicle understeer. Both this and a configuration with radial fronts and lower pressure radial rears resulted in increased closed-loop driver bandwidth but decreased time delay margins in the regulation task. On an overall subjective basis the two ordinary drivers disliked the bias front/radial rear configuration most since the reduced overall yaw velocity to steering gain forced more steering wheel activity in transient maneuver tasks. This was supported by qualitative steering activity measures.

by Richard H. Klein; Robert W. Humes
Systems Technology, Inc., 13766 South Hawthorne Blvd.,

Hawthorne, Calif. 90250

Contract DOT-HS-5-01080

Rept. No. TR-1060-1 ; 1975 ; 85p 9 refs

Rept. for Dec 1974-May 1975.

Availability: NTIS

HS-801 704

METHODOLOGIES FOR THE EVALUATION AND IMPROVEMENT OF EMERGENCY MEDICAL SERVICE SYSTEMS. VOL. 2. APPENDICES. FINAL REPORT

Detailed information is provided for: the numerous data and questionnaire forms developed for studies and surveys; enabling state legislation, training programs, medication and supplies, and sample transcripts of operational runs for the demonstration study of mobile intensive care units manned by paramedics; protocol for the demonstration of air ambulance helicopters, and contents of helicopter transportable field kits for mobile disaster teams.

by Robert B. Andrews; Louis E. Davis; James R. Bettman;
Ronald K. Granit; Kenneth F. Siler

University of California at Los Angeles, Div. of Res., 405

Hilgard Ave., Los Angeles, Calif. 90024

Contract FH-11-6849

March 31, 1976

HS-801 705

METHODOLOGIES FOR THE EVALUATION AND IMPROVEMENT OF EMERGENCY MEDICAL SERVICE SYSTEMS. VOL. 3. COMPUTERIZED AMBULANCE LOCATION LOGIC USERS MANUAL: PL/I AND FORTRAN VERSIONS. FINAL REPORT

An efficient and general method of seeking an optimal deployment of emergency medical vehicles (ambulances), in terms of minimizing response time, is presented. The method combines a queuing model, and optimum seeking nonlinear algorithm, and simulation. An actual application to the deployment of 14 ambulances in a portion of Los Angeles is presented. The queuing model describes a system in which the arrival rate is distributed in a Poisson manner, the service time having any distribution. The model is used to estimate a conditional mean response time for the given locations of hospitals and any initial set of locations of the emergency vehicle. It was found that the method can be used to estimate the operational characteristics of alternative configurations of systems for the delivery of emergency medical services, and that numerous policies for dispatch and transport of patients could be accommodated. The model program is included.

by James A. Fitzsimmons
University of California at Los Angeles, Div. of Res., 405
Hilgard Ave., Los Angeles, Calif. 90024
Contract FH-11-6849
1975 ; 120p 6refs
Rept. for 1 Jul 1968-31 Aug 1971. Vol. 1 is HS-801 648 and vol. 2 is HS-801 704.
Availability: NTIS

HS-801 710

THORACIC IMPACT INJURY MECHANISM. VOL. 1. FINAL REPORT

Mathematical modeling and related computer program development for the thorax under impact conditions are described. Literature is reviewed on the injury mechanism and mechanical properties of the major vessels, the heart, the trachea, the bronchi and lungs, the esophagus, the skeletal thorax, and the diaphragm. An experimental impact program conducted on Rhesus monkeys is described. Data were collected in three quasi-static and three dynamic tests. Injury thresholds were determined and clear, biplanar cineradiograms at 1200 frames per second were obtained. A finite element computer program was developed including mathematical models of the bony cage, the intercostal muscles, the heart, the major blood vessels, and the lungs. The program was used to study a cadaver impact situation and it is shown to compare favorably with experimental data.

by M. M. Reddi; H. C. Tsai; F. W. Wendt; V. A. Rogers; R. A. Erb; L. Ovenshire
Franklin Inst. Res. Labs., 20th and Race Sts., Philadelphia, Pa. 19103
Contract DOT-HS-243-2-424
Rept. No. F-C3417 ; 1975 ; 235p refs
Rept. for Jun 1972-Dec 1974. See also vol. 2, HS-801 711.
Availability: NTIS

HS-801 711

THORACIC IMPACT INJURY MECHANISM. VOL. 2. [APPENDICIES.] FINAL REPORT

Literature search abstracts, a bibliography, and personal contacts involved in a study of the mechanics of thoracic injury are provided concerning: general thoracic injuries, diaphragm injuries, skeletal system injuries, tracheobronchial injuries, esophageal injuries, lung injuries, cardiovascular injuries, thoracic impact experimental data, cadaver data validity, anthropometric dummies, material properties, protective equipment and injury, biodynamic modeling, and Rhesus monkey anatomy and physiology. The force deformation properties of human costo-vertebral articulations are modeled and line tracings of photographs of a sectioned Rhesus monkey are provided. Various necropsy reports with illustrations for several test monkeys are given. Protocol sheets are shown and the data acquired in the-quasi-static and dynamic testing are presented graphically. Also, the geometric data for the mathematical model of the human thorax are provided for the ribs, the vertebral column, the heart, the major vessels, the esophagus and trachea, and the diaphragm. Cross-sectional properties are detailed.

by M. M. Reddi; H. C. Tsai; F. W. Wendt; V. A. Rodgers; R. A. Erb; L. Ovenshire
Franklin Inst. Res. Labs., 20th and Race Sts., Philadelphia, Pa. 19103
Contract DOT-HS-243-2-424
Rept. No. F-C3417 ; 1975 ; 275p refs
Rept. for Jun 1972-Dec 1974. See also vol. 1, HS-801 710.
Availability: NTIS

HS-801 713

ACCIDENT AVOIDANCE TEST REPORT--NISSAN AND TOYOTA EXPERIMENTAL SAFETY VEHICLES. FINAL TEST REPORT

Accident avoidance evaluation of the two experimental safety vehicles (ESV) consisted of braking and steering performance tests, handling tests, and overturning immunity tests. The brake performance test series included: an ESV brake system description; pre-test brake conditioning; stopping distances tests; pedal force tests; emergency braking tests; brake system efficiency tests; and parking brake tests. In the steering performance test series transient and steady state yaw response tests were run. To evaluate handling performance a lateral acceleration, a trapezoidal steer, and a sinusoidal steer test were performed. The rollover stability of each vehicle was also determined. In comparison with ESV design requirements, it was found that both vehicles complied with accident avoidance performance conditions in almost every category, except for minor deviations. The appendix contains detailed test descriptions and results. Illustrations, tables, and numerous graphs are included.

by P. Boulay; T. Macaulay
Ultrasystems Inc., Dynamic Science Div., 1850 West Pinnacle
Peak Rd., Phoenix, Ariz. 85027
Contract DOT-HS-4-00860
Rept. No. 7310-75-116 ; 1975 ; 154n 6refs

THE EFFECT OF THE FUEL SHORTAGE ON TRAVEL AND HIGHWAY SAFETY

Information available on the effect of the recent fuel shortage, including the most important background events and detailed descriptions of the effects of the fuel shortage on the amount and characteristics of automotive travel are compiled. Estimates of the derived safety benefits and fuel conservation are presented in the report, and are based on data for 1973 and 1974. Major emphasis is placed on assessing the safety and conservation effects of the 55 mph national speed limit. Several conclusions were reached, based on the information in this report: percent reduction in the total number of accidents was greater than the percent reduction in travel; percent reduction in the number of fatal accidents was more than three times greater than the reduction in the total number of accidents; single vehicle, multivehicle, and pedestrian accidents had approximately the same percent decreases; the decreases in injuries and fatalities were greater on rural roads than on urban; the greatest reduction in fatalities occurred on high speed roads and the least occurred on roads unaffected by the new speed limit; the greatest percent decline in injuries were experienced at the more severe injury levels; there can be a high confidence that a large portion of the reduction in fatalities is due to the direct or indirect benefits of the 55 mph speed limit; total travel declined by 2.6%; the lower speed limit and consequent speed changes resulted in the savings of 30 to 46 million barrels of motor fuel; travel on main rural roads declined the most (3.3%); decline in travel was greatest during the first 4 months of 1974; weekend travel experienced 30% reduction; travel on the interstate rural system decreased the most; traveling speeds were reduced on all rural systems and on urban freeways; and gasoline sales for 1974 were about 3.7% below the 1973 level and well below the projected value. Daylight savings time did not have much effect on motor fuel conservation.

by Ezio C. Cerrelli
National Hwy. Traffic Safety Administration, Mathematical
Analysis Div., Washington, D.C. 20590
1975; 65p
Availability: NTIS

HS-801 716

AUTOMATIC VEHICLE CONTROLLER. OPERATOR'S AND MAINTENANCE MANUAL

This manual provides installation, operation, maintenance, and technical information on the Automatic Vehicle Controller System, addressed to the technical level. Chapters include: functional description for generator, radio control transmitter, hydraulic system, steering servomechanism, brake servomechanism, throttle servomechanism, clutch and fifth-wheel and lift assembly; installation, including the function generator package, radio transmitter, hydraulic system, steering servomechanism, braking, throttle and clutch servomechanisms, fifth-wheel and lift assembly and hydraulic fluid; operation procedures; preventive maintenance, including electronic subsystems, hydraulic subsystems, throttle actuator, clutch actuator and fifth wheel; theory of operation, including transmitter, receiver station, function generator; calibration and test procedure; troubleshooting; and wire lists.

Ultrasystems, Inc., Dynamic Science Div., 1850 West Pinnacle Peak Rd., Phoenix, Ariz. 85027
Contract DOT-HS-4-00860
1975; 100p
Availability: Reference copy only

HS-801 717

TESTING OF FOREIGN PROTOTYPE EXPERIMENTAL SAFETY VEHICLES-PROGRAM SUMMARY REPORT. FINAL REPORT

The testing conducted under the Foreign Experimental Safety Vehicle (ESV) Test and Evaluation Program and its results are summarized. Vehicles tested were two Fiats, a Nissan, and a Toyota ESV. Specific tests included: initial inspection and evaluation of design parameters (all vehicles); accident avoidance tests (Nissan and Toyota); crash injury reduction tests (front-to-front crashes on all vehicles and front-to-rear on the Toyota ESV); and post-crash evaluations. Accident avoidance tests included: braking performance tests (stopping distance, pedal force, emergency brake, brake efficiency, parking brake); steering performance tests (steady state and transient yaw response); handling tests (lateral acceleration, sinusoidal steer, trapezoidal steer); and overturning immunity tests (drastic steer and brake). Crash injury reduction tests included: a Nissan/AMF ESV's front-to-front impact at 60 mph (vehicle structural response, and 50th percentile anthropomorphic dummy response); a Toyota/AMF ESV's front-to-front impact at 60 mph (structural and dummy response); a Fiat 2000/AMF ESV's front-to-front impact at 75 mph (vehicle structural response); a Fiat 2500A/AMF ESV's front-to-front impact at 75 mph (vehicle response); a Fiat 2500B/AMF ESV's front-to-front impact at 50 mph (vehicle and dummy response); and a Toyota/AMF ESV's front-to-rear impact at 60 mph (vehicle structural response, dummy response). The energy-absorbing bumper system of the larger AMF ESV helped to decrease the severity of the impact results for the smaller ESV's. Mathematical modeling analyses of representative ESV vehicle-to-barrier and vehicle-to-vehicle impacts are discussed and detailed results of the analyses are appended.

by P. Boulay; S. Davis; N. Johnson
Ultrasystems, Inc., Dynamic Science Div., 1850 West Pinnacle Peak Rd., Phoenix, Ariz. 85023
Contract DOT-HS-4-00860
Rept. No. 2310-75-117; 1975; 84p 3refs
Rept. for Apr-1974-Jul 1975.
Availability: NTIS

HS-801 718

EVALUATION OF GLARE REDUCTION TECHNIQUES. FINAL REPORT

Degradation of the visual capacity of a motor vehicle driver caused by luminous sources on the driver's own vehicle during daylight is quantified according to luminance glare theory. Research was conducted in the following manner: review and reevaluate criteria for allowable glare; update and improve the performance of equipment developed for laboratory measurements of glare; test motor vehicles to determine glare introduced into a driver's eyes from his own vehicle; and analytically and experimentally determine methods for reducing glare. Effects of driver's age and daylight conditions are considered, and a means for laboratory measurements of vehi-

cle glare production characteristics is developed. A total of 20 vehicles (15 cars, 4 trucks, and 1 bus) were used for measurements in a rectangular building with a solar simulator of the glare perceived by looking straight forward and also the direct luminance of the brightest reflective sources on each vehicle. Based upon a probabilistic model of target detection, allowable glare in the field of view is determined. It is concluded that: most motor vehicles produce an unsatisfactorily high glare into the driver's eye under daylight driving conditions; by proper design procedures, glare levels can be held to tolerable levels; "spot" glare sources on the vehicle do not contribute directly in a substantial manner to the degradation of visual capability; the predominant glare source is the dash of the motor vehicle reflecting into the windshield and then into the drivers eye when the dash is illuminated with collimated light; and light from the sun reflected from the hood represents the brightest visible glare source produced from the vehicle.

by W. L. Raine; N. E. Chatterton; A. R. Dunn
Teledyne Brown Engineering, Cummings Res. Park,
Huntsville, Ala 35807
Contract DOT-HS-4-00925
Rept. No. EE-DOT-1905 ; 1975 ; 17p 19refs
Rept. for 14 Jun 1974-20 Jun 1975.
Availability: NTIS

HS-801 719

INFLATABLE BELT DEVELOPMENT FOR SUBCOMPACT CAR PASSENGERS. FINAL REPORT

The analyses, design, and testing conducted to develop an air-belt restraint system for a subcompact car capable of protecting the passenger in frontal and frontal oblique crashes up to 50 mph are summarized. Computer simulations were used to design two preliminary restraint systems: a 2-point force-limited airbelt across the occupant's torso; and a 3-point version of the airbelt much like a conventional 3-point belt system. Developmental sled tests (simulated 50 mph frontal barrier crash) were conducted to test the airbelt's ability to maintain low injury levels. A series of evaluation tests were conducted on the finalized restraint: sled tests with various occupant sizes (dummies from six year old to 95th percentile male), impact velocities (30, 38, 40 and 50 mph), and impact angles (frontal and frontal oblique); three car crash tests (full frontal impact of 1974 modified Ford Pinto with 1974 Ford LTD at 80 mph, modified Pinto in frontal crash at 41.5 mph with rigid barrier; and offset frontal impact of Pinto and LTD at 80 mph); and two sled tests with cadavers. It is concluded that: the force-limited 3-point airbelt restraint system will meet the injury criteria for a 5th percentile female to 95th percentile male in frontal impact somewhat over 50 mph; the six year old child is protected to approximately 47 mph in frontal impacts; the six year old child, 50th percentile male, and 95th percentile male all met the injury criteria in 38 mph 30 oblique impact from both the near and far sides of the vehicle; the standard seat locations in the Ford Pinto provide sufficient stroking room to bring the occupant to rest in 50 mph frontal impacts; belt anchor locations were determined giving stroke efficient system; both the 2-point and 3-point inflatable restraint systems were capable of meeting the injury criteria; the finalized airbelt restraint system is easily mass producible; the energy-absorbing belt anchors attenuate force otherwise transmitted to the occupant through the compartment; and the restraint

by Michael Fitzpatrick; Tim Egbert
Minicars, Inc., 35 La Patera Lane, Goleta, Calif. 93017
Contract DOT-HS-4-00917
1975 ; 20p
Rept. for 26 Jun 1974-18 Aug 1975. See also HS-801 720
(Executive Summary).
Availability: NTIS

HS-801 720

INFLATABLE BELT DEVELOPMENT FOR SUBCOMPACT CAR PASSENGERS. EXECUTIVE SUMMARY. FINAL REPORT

by Michael Fitzpatrick; Tim Egbert
Minicars, Inc., 35 La Patera Lane, Goleta, Calif. 93017
Contract DOT-HS-4-00917
1975 ; 38p
Rept. for Jun 1974-Aug 1975. For abstract, see HS-801 719.
Availability: NTIS

HS-801 721

THE DEVELOPMENT OF TECHNOLOGY FOR DETECTION OF MARIJUANA INTOXICATION BY ANALYSIS OF BODY FLUIDS. FINAL REPORT

A method employing high pressure liquid chromatography (hplc) plus mass spectrometry (ms) is described for the detection of low concentrations of delta 9-THC in marijuana. The method was then successfully applied to detecting and quantitating delta 9-THC which had been added to human blood plasma. Blood samples were taken from six male volunteers. Each subject then smoked one marijuana cigarette containing 10.8 milligrams delta 9-THC and blood samples were taken at 0, 0.25, 0.5, 1, 2, 3, 4, 12 and 24 hours after smoking. After the blood samples, breath and saliva samples were taken. Levels of delta 9-THC could be easily detected and quantified for 24 hours following the smoking. Results also indicate that a marijuana metabolite is present in blood plasma. This metabolite was detectable up to 24 hours after smoking and in fact was higher at this time than any other time following smoking. Detection of this metabolite was accomplished using an ultra-violet spectrophotometer attached to the hplc. Of the ten control subjects (non-marijuana smoking male laboratory workers) tested by the analysis method, none showed the presence of this metabolite. Therefore, it appears that numerous blood samples can be quickly and inexpensively screened by the hplc method for presence of this marijuana metabolite indicating prior marijuana use.

by P. J. Bryant; J. L. Valentine; P. L. Gutshall; O. H. M. Gan; P. Driscoll
University of Missouri, School of Pharmacy, Kansas City, Mo. 64108
Contract DOT-HS-4-00968
1975 ; 32p 7refs
Rept. for 27 Jun 1974-30 Jun 1975. Partially supported by the National Inst. on Drug Abuse.
Availability: NTIS

HS-801 722

HSL 76-03

HS-801 722

SPILLED FUEL IGNITION SOURCES AND COUNTERMEASURES. FINAL REPORT

The conditions under which motor vehicle crash fires are ignited are defined and countermeasures to reduce the incidence of these fires are proposed. Fuel and ignition system components are discussed: existing fuel systems (fuel tank locations, fuel lines, fuel pumps, evaporative control system, carburetors); and existing electrical systems (battery location and connection, vehicle wiring, vehicle lights, high-energy electrical components). The following fire countermeasures are considered: safety fuel tanks, fuel tank hardware; breakaway valves, inertia fuel shutoff valves, fuel lines and fittings of greater strength; inertia shutoff switches for the electrical system, and battery terminal protection. Potential sources of crash fire ignition are discussed: broken electrical wiring, broken headlights, displaced or broken battery, friction sparks, hot surfaces, engine backfires, and external ignition sources. The various sparks that could cause collision and gasoline and flammable material characteristics are considered. A series of four crash tests (a barrier test, two front-to-rear impact tests, and a rollover test) conducted to establish baseline conditions for crash fires is described. The development of the following new fire countermeasures is discussed: safety fuel tanks, fuel tank relocation, fuel shutoff valves, fuel line routing, line protection, battery protection, battery relocation, wire routing modifications, and inertia shutoff switches. The sled testing of inertia-sensitive fire countermeasures and the process of selecting countermeasures to be actually implemented for demonstration are described. It was found that commercially available inertia switches, coupled with a plastic shield for the positive battery terminal, effectively eliminated all electrical ignition fire sources. Fuel system countermeasures developed also proved to successfully prevent fuel spillage during the four crash situations tested. A cost-benefit analysis showed that a combined ignition source and fuel spillage countermeasure system which would be 100% effective in eliminating crash fires would not be cost effective. An electrical countermeasure system would become cost effective within three years. However, it is estimated that this system would eliminate only 85% of the crash fires.

by N. Johnson; S. Sanderson
Ultrasystem, Inc., Dynamic Science Div., 1850 West Pinnacle
Peak Rd., Phoenix, Ariz. 85027
Contract DOT-HS-4-00872
Rept. No. 2310-75-118; 1975; 260p 107refs
Rept. for Mar 1974-Aug 1975. See also HS-801 744 (Summary).
Availability: NTIS

HS-801 723

SUBCOMPACT CAR CRASHWORTHINESS PROGRAM. PROGRESS REPORT FOR JUNE AND JULY, 1975

Data is provided for the evaluation of the modified 1974 Pinto 2-door sedan with advanced driver and passenger restraints in

descriptions of the exterior structural damages and interior compartment damages of the two vehicles are given. A physical test data summary and detailed vehicle physical measurements are presented. All instrumentation in the Pinto and the dummies functioned properly. The dummy restraint was analyzed and measured injury levels were relatively low. The left clavicle of the Pinto passenger dummy suffered a failure across the mounting lug (photographs are provided).

Minicars, Inc., 35 La Patena Lane, Goleta, Calif. 93017
Contract DOT-HS-113-3-746
Rept. No. PR-Jun-75; PR-Jul-75; 1975; 75p
Availability: Reference copy only

HS-801 724

DEVELOPMENT OF IMPROVED INFLATION TECHNIQUES. FINAL REPORT

A program designed to develop an inflatable occupant restraint system which can protect passengers of full-size automobiles, in 50 mph frontal impacts, but which is not so violent an inflation as to injure an occupant seated in the path of the deploying inflatable is described. An inflator was developed incorporating an aspirator drawing a significant fraction of the cushion filling gas from the occupant compartment. The new restraint system (aspirator, gas source, cushion, knee target, foot cushion, seat block and dashboard pad) is discussed. Developmental dynamic testing was performed on an accelerator using a 1972 Impala passenger compartment with three anthropometric dummies (50th percentile male, 5th percentile female, 95th percentile male, and 6 year old child). Triaxial accelerometers were mounted in the dummies. The performance of the restraint system was judged according to: head injury criterion; chest acceleration levels; rebound velocity; femur fracture criterion; and containment. Six full-scale barrier crash tests were run at 30, 40, and 45 mph using 1974 Ford LTD pillared four-door sedans with modifications (hood attachment, equipment removal, front seat modifications, modifications for onboard photographic coverage, towing mechanism, and installation of restraint systems). Seven accelerometers were mounted at various vehicle locations and structural deformation was measured at 16 locations. The aspirated crash restraint system was proven to afford protection for normally seated adult occupants at 50 mph and for 6-year-old child sized occupants positioned forwardly at 30 mph. For a reinforced vehicle, a significant safety margin in all survival parameters has been shown. The 30-mph, 3-inch forward position case for the child sized occupant was shown to be the worst case in early testing. System changes made during the developmental testing phases may have an effect on the worst-case velocity or spacing or both. Attempts to gather data were hampered by instrumentation problems with the 6-year-old child dummy.

Rocket Res. Corp., 11441 Willows Rd., Redmond, Wash. 98052
Contract DOT-HS-344-3-690
1975; 53p
Rept. for Jun 1973-Aug 1975.
Availability: NTIS

HS-801 730

RESEARCH SAFETY VEHICLE (RSV). PHASE 2. STATUS REPORT NO. 1

A progress report on the development of a research safety vehicle (RSV) is presented. Thirteen Simca C-6 automobiles were subjected to front and rear structural crush tests, and full scale impact tests. Component tests were run on C-6, Audi and Volvo seats. Full scale tests involved a 35.3 mph barrier impact and a 50.5 mph front-to-rear collision. Computer simulations, based on the results of the C-6 crush tests, and of rear moving, front barrier, and RSV front barrier impacts are described. The required modifications needed to meet the frontal crush performance goal (of the front and rear portion of the rail, the sheet metal, tunnel area, radiator, and front bumper) are shown. Design considerations for the bumper system and restraint system development (inflatable occupant restraint systems - IORS) are discussed. Possible consumer reaction to a passive belt restraint system was evaluated. In the impact tests, dummies in the right front and left rear seating positions were restrained with lap-shoulder belts. The results of the static crush tests are discussed for the following structural components: engine mounts; rails and sheetmetal; rear rails and dash; radiator into engine; rear suspension; and the doors. A producibility analysis considering the global aspects of anticipated RSV design features and a report of weight control studies are also included.

Calspan Corp., Buffalo, N. Y. 14221
Contract DOT-HS-5-0214
Rept. No. PR-1; 1975; 75p
Rept. for 16 Jul-16 Sep 1975.
Availability: Reference copy only

HS-801 731

POLICE MANAGEMENT TRAINING. FACTORS INFLUENCING DWI ARRESTS. FINAL TECHNICAL REPORT

The development of training material for police management personnel concerning command and supervisory actions appropriate for more effective "driving while under the influence of alcohol" (DWI) enforcement is described. The program had the following steps: compile the training requirements (from the results of two studies identifying environmental and attitudinal factors that influence a patrolman's arrest decision); derive training objectives; select a training strategy; design training materials; conduct realistic pilot tests; and evaluate the materials. It is concluded that this project resulted in a training package presenting a necessary and interesting topic for which there is no existing counterpart. The format and presentation is found to be quite adequate.

by Edward W. Bishop
Dunlap and Assocs., Inc., 1 Parkland Drive, Darien, Conn.
06820
Contract DOT-HS-4-00987
1975; 70p
Rept. for Jun 1974-May 1975.
Availability: NTIS

HS-801 732

ALCOHOL, HIGHWAY SAFETY AND THE DWI DEFENSE ATTORNEY. FINAL TECHNICAL REPORT

The development, test and evaluation of training material for use in a seminar or briefing for attorneys concerned with the defense of clients charged with drunken driving (DWI) are described. The identification of training objectives and limitations on presentation format and style is stressed. The material was used and evaluated as a seminar by 30 members of the New Hampshire Bar Association. It is concluded that the training material is effective when used as a seminar briefing package for the DWI defense attorney.

Dunlap and Assocs., Inc., One Parkland Drive, Darien, Conn.
06820
Contract DOT-HS-4-00986
1975; 59p
Rept. for Jun 1974-Jun 1975.
Availability: NTIS

HS-801 733

MULTIDISCIPLINARY ACCIDENT INVESTIGATION DATA FILE, 1974. FINAL REPORT

A summary of contract accomplishments and a discussion of data preparation, data files and the data system for the 1974 Multidisciplinary Accident Investigation (MDAI) data file contract is presented. Also included are a list of all contract documentation and an index of all automated MDAI report publication numbers. About 10,000 clinical accident investigations have been conducted to-date (March 1975) and their reports are edited and processed into a common data base on a timely basis.

by J. C. Marsh, 4th
Highway Safety Res. Inst., Huron Pkwy. and Baxter Rd., Ann Arbor, Mich. 48105
Contract DOT-HS-4-00898
Rept. No. UM-HSRI-SA-75-6; 1975; 131p 14refs
Rept. for 1 Apr 1974-31 Mar 1975.
Availability: NTIS

HS-801 734

MODEL POLICE TRAFFIC SERVICES, POLICIES, PROCEDURES, RULES, AND REGULATIONS. MANUAL. PHASE 2. MODEL POLICE TRAFFIC SERVICES PROCEDURES

An attempt is made to provide police administrators and traffic commanders with policies, procedures, rules and regulations that can be incorporated into an existing traffic program and into the mechanics of policy formulation and execution. Highway safety procedures for traffic law enforcement, accident investigation, general motorist service, the control and direction of traffic and administrative activities are detailed by purpose and method. It is recommended that all procedures and policies be carefully reviewed, perhaps revised, before final adoption within an enforcement agency.

International Assoc. of Chiefs of Police, Inc., Hwy. Safety Div.
1975; 261p
Prepared for the National Hwy. Traffic Safety Administration.
On cover: "Model Police Traffic Services. Procedures." See

HS-801 735

UNIFORM TIRE QUALITY GRADING-- TREADWEAR. CITY TEST. FINAL REPORT

The development of a practical means of establishing relative passenger tire treadwear rates is discussed. Five thousand miles of repetitive testing over 39 miles of city streets and access roads generated data for establishing tread wear-rates of radial, bias-belted, and bias construction passenger tires. Test vehicles were 1975 Chevrolet Malibu 4-door sedans loaded to between 1140 and 1154 pounds per tire (at 24 pounds per square inch pressure). Drivers were rotated after each 39 mile run and tires were rotated one position clockwise after each 156 miles and to the next car after each 625 mile test increment. The method of the tread wear-rating calculations is described. The final test route (280 turns, 480 stops, and 480 starts per 156 mile segment) was modified from the original plan which put an extreme imposition on the mechanical integrity of the test cars. It is concluded that: good reliable data can be generated on a test course of the type used; the consistency of data and the good definition of the wear responses of all the tires achieved are significant in the establishment of treadwear rates; the problems encountered on urban-suburban thoroughfares need study to improve the city test; and the procedure, if provisions for brake cooling are made, may be the basis for an acceptable test method.

by R. N. Pierce; K. B. Davis
Southwest Res. Inst., P. O. Drawer 28510, San Antonio, Tex.
78284

Contract DOT-HS-5-01070

1975 ; 64p

Rept. for Apr-Jul 1975.

Availability: NTIS

HS-801 741

ANALYSIS OF METHODOLOGY FOR MEASURING NATIONAL HIGHWAY TRAFFIC SAFETY. FINAL REPORT

The current practices of the National Highway Traffic Safety Administration (NHTSA) in their measuring and reporting on the major variables affecting highway safety are investigated and improved techniques for a better representation of the national traffic situation are recommended. The current practice in developing indicators and descriptors is reviewed for various traffic and vehicle safety activities and the limitations and gaps in present methods of measurement are analyzed. It is recommended that NHTSA researchers: extend the current practice of depicting the traffic safety situation from fatalities to levels of injury-severity; adopt injury-severity per vehicle year, per driver year, per vehicle mile, and per accident as preferred traffic safety measures; adopt geographical regions for data collection in place of national statistics for purposes of projection and estimation; use geographical regions for the placement of Alcohol Safety Action Programs; and improve current data processing techniques to accommodate more descriptors dealing with program impact and to provide facility in retrieving data for reporting and policy purposes.

by Robert G. Hendrickson; Alexander R. Craw
National Bureau of Standards, Technical Analysis Div.,
Washington, D. C. 20234

Rept. No. NBSIR-74-561 ; 1974 ; 43p

Prepared for the Mathematical Analysis Div. of the National

HS-801 742

STATEWIDE HIGHWAY SAFETY PROGRAM ASSESSMENT. A NATIONAL ESTIMATE OF PERFORMANCE. JULY, 1975

An attempt is made to measure highway traffic safety performance nationwide over a span of six years (1969-1974). Highway safety operational outputs, state/local expenditures and federal funds used, and program performance trends (how their growth matched growth in highway risks) are examined. Ten states (Arkansas, Florida, Iowa, Nevada, New Hampshire, New Jersey, Ohio, Utah, Virginia, and Washington) were selected for their national representation and within each state 10 localities were selected for study for their state representation. In these sample areas, the performance of the following general highway safety programs was assessed: police traffic services and adjudication; drinking-driver counter-measures; emergency medical services; driver education; driver licensing; and periodic motor vehicle inspection. Also, the funding of these programs was examined. It was found that: most highway safety performance indicators are improved when measured against the expanding traffic environment; productivity, in program areas which are manpower or unit intensive, has been rising; the cumulative real growth (in 1974 dollars) for all federal highway safety programs has been 18%; total highway safety expenditures are leveling off in terms of 1974 dollars; state and community federal grants amount to slightly over two percent of total expenditures; and the catalytic effect of state and community grants is most noticeable in several emphasis areas, such as alcohol and emergency medical services.

National Hwy. Traffic Safety Administration, Planning and
Evaluation, Washington, D.C.

1975 ; 145p

Availability: Corporate author

HS-801 743

EFFECT OF PASSENGER LOADING ON DRIVER'S VISIBILITY [FIELD OF VIEW] FROM AUTOMOBILES

An attempt is made to determine the relationship between the number of passengers in an automobile and the extent of obstruction to driver field of view and the frequency with which various numbers of passengers are found in vehicles on the road. The effect on driver field of view of the following conditions is analyzed: a compact car with standard inside & outside mirrors and 5 passengers; a compact car with a standard outside and oversize inside mirror and 3 passengers; a full-sized car with a standard outside and elongated inside mirror and 5 passengers; an intermediate-sized car with center front seat occupants and right front seat occupants; a full-sized car with a center front seat occupant; and an intermediate-sized sports car with a right front seat occupant. A total of 1,927 observations of vehicle occupancy was made by four members of the Office of Driver and Pedestrian Research on their trips to and from work. The number of vehicle occupants and the automobile size category (sports car, subcompact/compact, intermediate/full-size, and station wagon) were noted. Both direct and indirect visibility from passenger vehicles was shown to be sensitive to passenger loading. The driver's side and rear view were shown to be reduced by 45-52% depending on body style and rear view mirror configuration. It was also

problem requiring further consideration and countermeasure development.

by Robert L. Henderson
National Hwy. Traffic Safety Administration, Office of Driver
and Pedestrian Res.
1975 ; 15p
Availability: NHTSA

HS-801 744

SPILED FUEL IGNITION SOURCES AND COUNTERMEASURES. SUMMARY REPORT. FINAL REPORT

Ultrasystems, Inc., Dynamic Science Div., 1850 West Pinnacle
Peak Road, Phoenix, Ariz. 85027
Contract DOT-HS-4-00872
Rept. No. 2310-75-119 ; 1975 ; 28p 3refs
Rept. for Mar 1974-Aug 1975. For abstract see HS-801 722.
Availability: NTIS

HS-801 745

INTERNATIONAL CONGRESS ON AUTOMOTIVE SAFETY (4TH) PROCEEDINGS, JULY 14-16, 1975

The proceedings of the Fourth International Congress on Automotive Safety are presented. Separate presentations cover the following topics: vehicle safety improvements using vehicle characteristic ratings; setting relevant safety standards for fatal tractor trailer crashes; the individual versus collective responsibility for safety; cost-benefit versus total benefit for safety standards; decision making criteria for ranking standards; fire in motor vehicle accidents; state participation in the development of federal safety standards; safety versus cost savings; societal costs of motor vehicle accidents; cost-benefit and cost-effectiveness analyses in determining priorities among standards, programs, and projects; European approaches to safety standards; a review and critique of the National Highway Traffic Safety Administration's (NHTSA) revised restraint system cost-benefit analysis; compulsory seat belt wearing in France; the role of legislation in shaping future automobile safety; a new proposed code of standards for the automobile industry; the evaluation and improvement of automobile safety through regulation; recommendations for increased occupant safety; and automobile transportation cost tradeoffs. Also considered are the following aspects of motor vehicle safety: safety standards for the handicapped driver; considerations of priority in standards; a program for evaluating active restraint systems; enhancing the cost effectiveness of safety regulations; judicial versus legislative methods of standard setting; integrating vehicle safety, costs, and consumer attitudes; and research and development in future automobile regulation. Topics of a more technical nature include: vehicle safety legislation and international trade; practical aspects of child restraint system standards; the political determinants of occupant restraint; seat belt use laws on the national and international scene; cost-benefit considerations of safety versus energy consumption; accident investigation in the evaluation of safety standards; the reduction in societal costs by safety systems; factors contributing to accident fatalities in 1974; the effects of standards on international trade; the Australian approach to automobile safety standards; an array of social values relating to safety regulations; societal priorities in occu-

National Hwy. Traffic Safety Administration
1975 ; 990p refs
Includes HS-016 894, HS-017 129--135, HS-017 137--168, and
HS-017 751--756.
Availability: GPO

HS-801 746

COMMERCIAL DRIVING SCHOOL INSTRUCTOR: PROJECT AT OHLONE COLLEGE. FINAL REPORT

The development of a two-year associate degree curriculum for training driving school instructors at Ohlone College in Fremont, California is discussed. A review of literature was conducted to identify trends in professionalization of driver training instructors. The methodology of selecting community colleges for the program and evaluating the proposed curricula is presented. The following aspects of the Ohlone College program are discussed: curriculum development; the Guide for Teacher Preparation in Driver Education--Driving School Edition; the development of instructional aids; the interaction with California Safety and education agencies; the interaction with trade and professional associations; and the impact of the program on primary groups (industry, students, the college, the community, state agencies, and other community colleges). It is concluded that: the Ohlone College project supports the contention that there is a need for such driver instructor training programs; the length and comprehensiveness of the programs must vary with the job goals of the students; community colleges must consider the adoption of a total traffic safety manpower training program leading to sub-baccalaureate degrees and training; and the primary purpose of any program is not the degree but the preparation of people for job opportunities in the commercial driving school instructor field.

American Assoc. of Community and Junior Colleges, One
Dupont Circle, N.W., Washington, D.C. 20036
Contract DOT-HS-207-2-337
1975 ; 55p 36refs
Rept. for Apr 1972-Aug 1975.
Availability: NTIS

HS-801 749

SUBCOMPACT CAR CRASHWORTHINESS PROGRAM. PROGRESS REPORT, AUGUST 1975

Using a towmotor facility, 30 crash tests were performed with 1974 Ford Pintos as both target and bullet vehicles. Target vehicles were placed across the paths of the bullet vehicles at an angle of 60°. A modified and an unmodified Pinto with accelerometer transducers and instrumentation boxes and two male 50th percentile anthropometric dummies were used as target vehicles. Triaxial accelerometers were installed in the head and chest and a biaxial accelerometer was installed in the pelvis of the dummies. Three onboard cameras viewed the dummy response to impact. An unmodified and a modified Pinto with optional 2.3 liter engine and a 4-speed transmission were used as bullet vehicles. A modified, fully instrumented 1974 Pinto sedan, was also used in a 30 barrier impact test at 50 mph. The same types of anthropometric dummies protected by advanced passive restraints with accelerometers mounted at head, chest, and femurs were used. Test site preparations included set up of photographic equipment, visual event market

and speed trap. In the dual-vehicle tests, it was found that the peak acceleration force was about 42,000 pounds, although it occurred earlier using the modified bullet vehicle and was 10% higher. In the 30 barrier test, the interior of the vehicle was essentially undamaged, and despite the loss of 14 to 31 data channels, vehicle crashworthiness was demonstrated.

Minicars, Inc., 35 La Patera Lane, Goleta, Calif. 93017
Contract DOT-HS-113-3-746
Rept. No. PR-Aug-75 ; 1975 ; 73p
Availability: Reference copy only

HS-801 750

ACCIDENT INVESTIGATION AND REPORTING

The legal framework for our accident analysis system is dealt with. State laws, as current on January 1, 1975, are reviewed as they relate to accident reports and accident investigations in the context of comparable provisions of the Uniform Vehicle Code. Provisions of the Code discussed reflect the 1975 revisions. Discussion of reportable accidents includes defining what is an accident and where accident laws apply. Information exchanged at the scene deals with accidents resulting in death, injury, or damage to an attended vehicle, as well as those resulting in damage to an unattended vehicle. Accident investigation by the police concerns notification of police and police investigation and reports. Written reports by involved parties covers the driver's report, who reports when the driver is incapacitated, supplemental written reports, confidential or privileged status and use of written reports, local authorities' report requirements, false reports, and failure to report. Special investigations include coroner's reports, tests for alcohol or drugs, and activities of the motor vehicle department.

National Com. on Uniform Traffic Laws and Ordinances
Contract DOT-HS-4-00928
Publ: Traffic Laws Commentary v4 n2 p1-72 (Sep 1975)
1975 ; 75p refs
Availability: GPO, \$1.35, stock number 050-003-00222-4

HS-801 751

OCCUPANT SURVIVABILITY IN LATERAL COLLISIONS. PROGRESS REPORTS 7-13, 1 FEBRUARY 1975 TO 31 AUGUST 1975

Progress reports are presented of an investigation into the feasibility of modifications to the vehicle interior and glazing which, when combined with structural modifications to upgrade compartment integrity, will allow occupants to survive severe lateral collisions in a completely passive manner. Main elements of the overall project are: baseline lateral collision tests (moving barrier striking vehicle at 29.6 mph, and a lateral impact into front left corner of vehicle at 51.9 mph); investigating advanced interior padding and glazing materials and configurations (39.1 mph impacts between a striking vehicle with bumper reinforcement assembly and a structurally modified struck vehicle with and without interior padding); fabrication of vehicles incorporating modified structures and interiors; and performing lateral collision tests on the modified vehicles (29.8 and 30.2 mph lateral impacts between a striking vehicle and a moving barrier and struck vehicles with structural modifications on upper door frames, operational laminated glazing material on both front doors, both side

addition, two final crash tests were performed on modified vehicles (perpendicular side impacts at 50.5 and 39.2 mph). Specific conclusions and recommendations are being formulated.

Calspan Corp., Buffalo, N.Y. 14221
Contract DOT-HS-4-00922
Rept. No. PR-7; PR-8; PR-9; PR-10; PR-11; PR-12; PR-13
1975 ; 509p
Availability: Corporate author

HS-801 752

ADVANCED PASSIVE RESTRAINT SYSTEM FOR SUBCOMPACT SIZE VEHICLE FRONT SEAT PASSENGERS. PROGRESS REPORTS 14 AND 15, 4 AUGUST 1975 TO 5 OCTOBER 1975

The following has been accomplished: tests to determine influence of bending moments on the crush force of modified energy absorbing steering columns; the issuance of purchase orders for all remaining hardware required for the additional tests; and a preliminary test plan for the remaining sled tests. It is planned that the remaining 14 sled tests will be conducted during the third and fourth weeks of October 1975. Interim results for an energy absorbing steering column test, and an outline of proposed sled tests is included.

Calspan Corp., Buffalo, N.Y. 14221
Contract DOT-HS-4-00972
Rept. No. PR-14; PR-15 ; 1975 ; 14p
Availability: Corporate author

HS-801 755

TRAFFIC SAFETY HIGHLIGHTS, PROBLEMS AND PROGRAMS. A SUMMARY REVIEW, JUNE 1974 THROUGH JUNE 1975

Traffic safety highlights, problems and programs include traffic safety as it is related to alcohol and drug abuse, the 55 mph speed limit, crash avoidance and survival, driver licensing, traffic safety priorities and administration, and driver education. Other topics include: traffic records systems; manpower development; traffic safety litigation; the National Motor Vehicle Advisory Council; the motorcyclist; police service and integrated vehicle systems. Annexes include a NHTSA organizational chart; history of NHTSA personnel strengths; summary of authorization and appropriations; monthly traffic fatality figures; and the percent reduction of traffic fatalities.

National Hwy. Traffic Safety Administration
1975 ; 26p
Availability: Corporate author

HS-801 757

TIPS ON CAR CARE AND SAFETY FOR DEAF DRIVERS

This manual explains how a deaf or severely hard of hearing driver can use sight, vibration sensation, and smell to replace hearing in caring for his car and driving safely. Signs of trouble discussed include: what the driver should look for when

March 31, 1976

HS-801 757

car troubles may be signaled by unusual vibrations. Safe driving tips, aimed at the new or learning driver, include: notes on attitude; means for avoiding dangerous situations and bad driving habits; what to do if stopped by a policeman, or involved in or witnessing an accident; and necessary or useful equip-

ment to carry in the car.

National Hwy. Traffic Safety Administration, Washington,
D.C. 20590

1975 : 42p

Availability: Corporate author

INDEX to ABSTRACTS

KWOC Title Index

ABILITY

INTERINDIVIDUAL DIFFERENCES IN MESOPIC
NIGHT VISION ABILITY MEASURED BY THE
MESOPTOMETER

HS-017 481

ACCESS

ANALYSIS OF DRIVER CONTROL MOVEMENTS ON
A LIMITED-ACCESS DIVIDED HIGHWAY

HS-017 489

ACUTE

DELAYED EFFECTS OF ACUTE ALCOHOLIC INTOXI-
CATION ON PERFORMANCE WITH REFERENCE TO
WORK SAFETY

HS-017 510

ADD

ADD-ON BIKE SEATS FOR CHILDREN

HS-017 490

ADJUSTING

METHOD OF CHECKING AND ADJUSTING BRAKES
OF THE GAZ-21 ON THE BASIS OF BRAKING TIME

HS-017 455

AGE

INTERACTIONS OF OCCUPANT AGE, VEHICLE
WEIGHT, AND THE PROBABILITY OF DYING IN A
TWO-VEHICLE CRASH

HS-017 472

AIR

AUTOMOTIVE OCCUPANT PROTECTIVE SAFETY AIR
CUSHION [AIR BAG] EXPENDITURE/BENEFIT
STUDY

HS-017 476

AUTOMOTIVE OCCUPANT PROTECTIVE SAFETY AIR
CUSHION %AIR BAG% EXPENDITURE/BENEFIT
STUDY [APPENDIX I. COMPUTER RUN SUMMARY]

HS-017 475

DE LOREAN REPORT TO FEDERAL ENERGY AD-
MINISTRATION SAYS FUEL SAVING CARS NEED
AIR BAGS [NEWS RELEASE]

HS-017 474

THE NEW AIR BRAKE SYSTEMS--AN IMPACT OVER-
VIEW

HS-017 558

ALCOHOL

ALCOHOL, HIGHWAY SAFETY AND THE DWI
DEFENSE ATTORNEY. FINAL TECHNICAL REPORT

HS-801 732

COMMENTS ON ALCOHOL INVOLVEMENT IN
FATAL AND NON-FATAL CRASHES

HS-017 562

DRUGS (OTHER THAN ALCOHOL) AND DRIVING

HS-017 561

EVALUATING THE EFFECTIVENESS OF REEDUCA-
TION PROGRAMS FOR CONVICTED [ALCOHOL] IM-
PAIRED DRIVERS

HS-017 458

ALCOHOLIC

DELAYED EFFECTS OF ACUTE ALCOHOLIC INTOXI-
CATION ON PERFORMANCE WITH REFERENCE TO
WORK SAFETY

HS-017 510

ALLOY

EVALUATING THE EFFECTS OF CORROSION ON
STRUCTURAL MATERIALS. A STUDY OF PLAIN
CARBON AND HIGH STRENGTH LOW ALLOY
STEELS

HS-017 453

AMBULANCE

METHODOLOGIES FOR THE EVALUATION AND IM-
PROVEMENT OF EMERGENCY MEDICAL SERVICE
SYSTEMS. VOL. 3. COMPUTERIZED AMBULANCE
LOCATION LOGIC USERS MANUAL: PL/I AND FOR-
TRAN VERSIONS. FINAL REPORT

HS-801 705

ANALYTICAL

THE DEVELOPMENT AND COMPARATIVE EVALUA-
TION OF ANALYTICAL TIRE MODELS FOR DYNAM-
IC VEHICLE SIMULATION. FINAL REPORT

HS-017 548

APPENDICIES

THORACIC IMPACT INJURY MECHANISM. VOL. 2.
[APPENDICIES.] FINAL REPORT

HS-801 711

APPLICABILITY

NEW TRANSIT MODES: APPLICABILITY AND CUR-
RENT STATUS

HS-017 449

ARRESTS

POLICE MANAGEMENT TRAINING. FACTORS IN-
FLUENCING DWI ARRESTS. FINAL TECHNICAL RE-
PORT

HS-801 731

ATTITUDES

ASSESSMENT OF PEDESTRIAN ATTITUDES AND
BEHAVIOR IN SUBURBAN ENVIRONMENTS

HS-017 517

ATTORNEY

ALCOHOL, HIGHWAY SAFETY AND THE DWI
DEFENSE ATTORNEY. FINAL TECHNICAL REPORT

HS-801 732

AUSTRALIA

REFLECTORISED NUMBER (LICENCE) PLATES
[REFLECTORIZED LICENSE PLATES] AND TRAFFIC
SAFETY IN AUSTRALIA

HS-017 518

THE INTRODUCTION OF COMPULSORY SEAT BELT
WEARING LAWS IN AUSTRALIA AND THEIR EF-
FECT

HS-017 567

AUTOMATIC

AUTOMATIC VEHICLE CONTROLLER. OPERATOR'S

| | | | |
|---|------------|---|------------|
| THE EFFECT OF AUTOMATIC TRANSMISSIONS ON MILITARY TRUCK FUEL ECONOMY | HS-017 450 | BEAMS DEVELOPMENT OF LIGHTWEIGHT DOOR INTRUSION BEAMS UTILIZING AN ULTRA HIGH STRENGTH STEEL | HS-017 486 |
| AUTOMATICALLY A UNIQUE CONCEPT FOR AUTOMATICALLY CONTROLLING THE BRAKING ACTION OF WHEELED VEHICLES DURING MINIMUM DISTANCE STOPS | HS-017 501 | EXPERIMENTAL AND COMPUTER SIMULATION EVALUATION OF HEADLAMP BEAMS | HS-017 457 |
| AUTOMOBILE THE EFFECTS OF AUTOMOBILE SAFETY REGULATION | HS-017 477 | EYE FIXATIONS OF DRIVERS IN NIGHT DRIVING WITH THREE HEADLIGHT [HEADLAMP] BEAMS. FINAL REPORT | HS-017 547 |
| AUTOMOBILES CHILDREN AS PASSENGERS IN AUTOMOBILES: THE NEGLECTED MINORITY ON THE NATION'S HIGHWAYS | HS-017 493 | BEARINGS EARLY DETECTION OF DEFECTS IN ROLLING-ELEMENT BEARINGS | HS-017 448 |
| EFFECT OF PASSENGER LOADING ON DRIVER'S VISIBILITY [FIELD OF VIEW] FROM AUTOMOBILES | HS-801 743 | BEHAVIOR ASSESSMENT OF PEDESTRIAN ATTITUDES AND BEHAVIOR IN SUBURBAN ENVIRONMENTS | HS-017 517 |
| EFFECT OF 55-MPH SPEED LIMIT ON AVERAGE SPEEDS OF FREE-FLOWING AUTOMOBILES ON AN INTERSTATE BRIDGE IN WEST VIRGINIA | HS-017 575 | EFFECTS OF INCREASED ENFORCEMENT AT URBAN INTERSECTIONS ON DRIVER BEHAVIOR AND SAFETY | HS-017 515 |
| AVERAGE EFFECT OF 55-MPH SPEED LIMIT ON AVERAGE SPEEDS OF FREE-FLOWING AUTOMOBILES ON AN INTERSTATE BRIDGE IN WEST VIRGINIA | HS-017 575 | METHODS OF MEASURING DRIVER BEHAVIOUR [BEHAVIOR] | HS-017 565 |
| AVOIDANCE ACCIDENT AVOIDANCE TEST REPORT--NISSAN AND TOYOTA EXPERIMENTAL SAFETY VEHICLES. FINAL TEST REPORT | HS-801 713 | BEHAVIOUR METHODS OF MEASURING DRIVER BEHAVIOUR [BEHAVIOR] | HS-017 565 |
| AXLE THE STRUGGLE OVER WHAT'S UP FRONT [THE ARGUMENT ABOUT FRONT AXLE WEIGHT MAXIMUM] | HS-017 576 | BELT CONCEPTS IN SAFETY BELT TESTING. FINAL REPORT | HS-017 553 |
| BAG AUTOMOTIVE OCCUPANT PROTECTIVE SAFETY AIR CUSHION [AIR BAG] EXPENDITURE/BENEFIT STUDY | HS-017 476 | INFLATABLE BELT DEVELOPMENT FOR SUBCOMPACT CAR PASSENGERS. FINAL REPORT | HS-801 719 |
| AUTOMOTIVE OCCUPANT PROTECTIVE SAFETY AIR CUSHION %AIR BAG% EXPENDITURE/BENEFIT STUDY [APPENDIX I. COMPUTER RUN SUMMARY] | HS-017 475 | INFLATABLE BELT DEVELOPMENT FOR SUBCOMPACT CAR PASSENGERS. EXECUTIVE SUMMARY. FINAL REPORT | HS-801 720 |
| BAGS DE LOREAN REPORT TO FEDERAL ENERGY ADMINISTRATION SAYS FUEL SAVING CARS NEED AIR BAGS [NEWS RELEASE] | HS-017 474 | THE INTRODUCTION OF COMPULSORY SEAT BELT WEARING LAWS IN AUSTRALIA AND THEIR EFFECT | HS-017 567 |
| BARRIER FULL SCALE CRASH TESTS OF A TIRE-SAND INERTIA BARRIER. INTERIM REPORT | HS-017 462 | THE SEAT BELT ARGUMENT | HS-017 566 |
| | | BELTED EFFECTS OF INTERMIXING OF BIAS, BIAS BELTED, AND RADIAL PLY PASSENGER TIRES ON VEHICLE DYNAMICS AND DRIVER/VEHICLE RESPONSES. FINAL REPORT | HS-801 702 |
| | | BELTS SERIOUS TRAUMA TO CAR OCCUPANTS WEARING SEAT BELTS | HS-017 494 |

DYNAMICS AND DRIVER/VEHICLE RESPONSES.
FINAL REPORT

HS-801 702

BIBLIOGRAPHY

TRAFFIC SIGNAL WARRANTS. A BIBLIOGRAPHY

HS-017 492

BICYCLE

BICYCLE INJURIES: ONE-YEAR SAMPLE IN CALGARY [CANADA]

HS-017 428

COMPENDIUM OF PEDESTRIAN-BICYCLE SAFETY PROGRAMS

HS-017 471

BIKE

ADD-ON BIKE SEATS FOR CHILDREN

HS-017 490

BLENDS

IDENTIFICATION OF ELASTOMERS IN TIRE SECTIONS BY TOTAL THERMAL ANALYSIS. 2. WHITE SIDEWALL COMPOUNDS OF EPDM AND BLENDS

HS-017 549

IDENTIFICATION OF ELASTOMERS IN TIRE SECTIONS BY TOTAL THERMAL ANALYSIS. 3. WHITE SIDEWALL COMPOUNDS OF NEOPRENE RUBBER BLENDS

HS-017 550

BLOCKING

EVALUATION OF WHEEL BLOCKING FOR VEHICLES PARKED ON SLOPES

HS-017 511

BLOWER

LOW NOISE OPPOSED PISTON TWO-STROKE ENGINE AND BLOWER

HS-017 545

BODY

THE DEVELOPMENT OF TECHNOLOGY FOR DETECTION OF MARIJUANA INTOXICATION BY ANALYSIS OF BODY FLUIDS. FINAL REPORT

HS-801 721

BORDENTOWN

HIGHWAY ACCIDENT REPORT. GEORGE WOLLMAN MEATS, INC., TRUCK/AUTO/GREYHOUND BUS COLLISION AND FIRE, NEW JERSEY TURNPIKE, BORDENTOWN, NEW JERSEY, OCTOBER 19, 1973

HS-017 491

BRAKE

THE NEW AIR BRAKE SYSTEMS--AN IMPACT OVERVIEW

HS-017 558

BRAKES

METHOD OF CHECKING AND ADJUSTING BRAKES OF THE GAZ-21 ON THE BASIS OF BRAKING TIME

HS-017 455

VEHICLES DURING MINIMUM DISTANCE STOPS

HS-017 501

METHOD OF CHECKING AND ADJUSTING BRAKES OF THE GAZ-21 ON THE BASIS OF BRAKING TIME

HS-017 455

BRIDGE

EFFECT OF 55-MPH SPEED LIMIT ON AVERAGE SPEEDS OF FREE-FLOWING AUTOMOBILES ON AN INTERSTATE BRIDGE IN WEST VIRGINIA

HS-017 575

BURN

A SURVEY OF MOTOR VEHICLE BURN ACCIDENTS IN CHILDREN: REPORT OF 45 CASES

HS-017 499

BUS

HIGHWAY ACCIDENT REPORT. GEORGE WOLLMAN MEATS, INC., TRUCK/AUTO/GREYHOUND BUS COLLISION AND FIRE, NEW JERSEY TURNPIKE, BORDENTOWN, NEW JERSEY, OCTOBER 19, 1973

HS-017 491

SAFETY IN MASS TRANSIT: A CASE STUDY OF BUS ACCIDENTS IN WASHINGTON, D.C.

HS-017 504

BUSES

SURVEY OF SAFETY RELATED CONDITIONS IN SCHOOL BUSES. FINAL REPORT

HS-801 659

CALGARY

BICYCLE INJURIES: ONE-YEAR SAMPLE IN CALGARY [CANADA]

HS-017 428

CALIBRATION

ESTABLISHMENT AND CALIBRATION OF A TREAD WEAR TEST COURSE

HS-017 496

CALIFORNIA

MOTORCYCLE TRAINING FOR CALIFORNIA DRIVER LICENSING PERSONNEL. FINAL REPORT

HS-017 459

THE TRANSPORTATION INDUSTRY CONFERENCE ON INFLATION, LOS ANGELES, CALIFORNIA, SEPTEMBER 19-20, 1974

HS-017 505

CANADA

BICYCLE INJURIES: ONE-YEAR SAMPLE IN CALGARY [CANADA]

HS-017 428

TRAFFIC SAFETY. PROCEEDINGS OF THE SCIENTIFIC CONFERENCE, OTTAWA, ONTARIO, CANADA, MAY 23 AND 24, 1974

HS-017 559

CAPACITY

CAPACITY ANALYSIS TECHNIQUES FOR DESIGN AND OPERATION OF FREEWAY FACILITIES. FINAL REPORT

HS-017 520

CAR

INFLATABLE BELT DEVELOPMENT FOR SUBCOMPACT CAR PASSENGERS. FINAL REPORT

HS-801 719

INFLATABLE BELT DEVELOPMENT FOR SUBCOMPACT CAR PASSENGERS. EXECUTIVE SUMMARY. FINAL REPORT

HS-801 720

SERIOUS TRAUMA TO CAR OCCUPANTS WEARING SEAT BELTS

HS-017 494

SUBCOMPACT CAR CRASHWORTHINESS PROGRAM. PROGRESS REPORT FOR JUNE AND JULY, 1975

HS-801 723

SUBCOMPACT CAR CRASHWORTHINESS PROGRAM. PROGRESS REPORT, AUGUST 1975

HS-801 749

TIPS ON CAR CARE AND SAFETY FOR DEAF DRIVERS

HS-801 757

CARBON

COOPERATIVE EVALUATION OF TECHNIQUES FOR MEASURING NITRIC OXIDE AND CARBON MONOXIDE (PHASE 4 TESTS)

HS-017 443

EVALUATING THE EFFECTS OF CORROSION ON STRUCTURAL MATERIALS. A STUDY OF PLAIN CARBON AND HIGH STRENGTH LOW ALLOY STEELS

HS-017 453

CARRIER

MOTOR CARRIER ACCIDENT INVESTIGATION. WARE OIL AND SUPPLY CO., INC. ACCIDENT--MARCH 1, 1975--PERRY, FLORIDA

HS-017 478

CARS

DE LOREAN REPORT TO FEDERAL ENERGY ADMINISTRATION SAYS FUEL SAVING CARS NEED AIR BAGS [NEWS RELEASE]

HS-017 474

ELECTRIC CARS

HS-017 479

EMISSIONS AND ECONOMY OF FOUR DIESEL CARS

HS-017 582

RESTRAINT USE AND EFFECTIVENESS IN REAL-WORLD CRASHES; FEW CHILDREN PROTECTED IN CARS; [AND] PAPERS RELEVANT TO FEDERAL MOTOR VEHICLE SAFETY

HS-017 507

CASE

SAFETY IN MASS TRANSIT: A CASE STUDY OF BUS ACCIDENTS IN WASHINGTON, D.C.

HS-017 504

CAST

EFFECTS OF GRAPHITE MORPHOLOGY, MATRIX HARDNESS, AND STRUCTURE ON THE FATIGUE RESISTANCE OF GRAY CAST IRON

HS-017 441

CASUALTY

REAR-IMPACTED VEHICLE COLLISIONS: FREQUENCIES AND CASUALTY PATTERNS. FINAL REPORT

HS-017 461

CCRV

A CYBERNETICALLY COUPLED RESEARCH VEHICLE [CCRV]

HS-017 451

CHAMBER

COMBUSTION PROCESS FUNDAMENTALS AND COMBUSTION CHAMBER DESIGN FOR LOW EMISSIONS

HS-017 523

CHARACTERISTICS

DRIVER RESPONSE TO THE 55 MPH MAXIMUM SPEED LIMIT AND THE VARIATIONAL CHARACTERISTICS OF SPOT SPEEDS

HS-017 464

EMISSION FORMATION CHARACTERISTICS OF THE DIESEL COMBUSTION PROCESS AND ESTIMATED FUTURE DEVELOPMENT TRENDS

HS-017 524

MEASURED ILLUMINATION CHARACTERISTICS OF THE 1974 HEADLAMPS. PART I. THE S.A.E. HEADLAMPS

HS-017 555

CHARGE

PRECHAMBER AND VALVE GEAR DESIGN FOR 3-VALVE STRATIFIED CHARGE ENGINES

HS-017 526

CHECKING

METHOD OF CHECKING AND ADJUSTING BRAKES OF THE GAZ-21 ON THE BASIS OF BRAKING TIME

HS-017 455

CHILDREN

A SURVEY OF MOTOR VEHICLE BURN ACCIDENTS IN CHILDREN: REPORT OF 45 CASES

HS-017 499

ADD-ON BIKE SEATS FOR CHILDREN

HS-017 490

CHILDREN AS PASSENGERS IN AUTOMOBILES: THE NEGLECTED MINORITY ON THE NATION'S HIGHWAYS

HS-017 493

RESTRAINT USE AND EFFECTIVENESS IN REAL-WORLD CRASHES; FEW CHILDREN PROTECTED IN CARS; [AND] PAPERS RELEVANT TO FEDERAL MOTOR VEHICLE SAFETY

HS-017 507

CITY

UNIFORM TIRE QUALITY GRADING--TREADWEAR. CITY TEST. FINAL REPORT

HS-801 735

COLLISION

HIGHWAY ACCIDENT REPORT. GEORGE WOLLMAN MEATS, INC., TRUCK/AUTO/GREYHOUND BUS COLLISION, AND FIRE. NEW BEDFORD, WUMPIKE, D.C.

HS-801 751
 REAR-IMPACTED VEHICLE COLLISIONS: FREQUENCIES AND CASUALTY PATTERNS. FINAL REPORT
 HS-017 461

COMBUSTION

COMBUSTION PROCESS FUNDAMENTALS AND COMBUSTION CHAMBER DESIGN FOR LOW EMISSIONS

HS-017 523

EMISSION FORMATION CHARACTERISTICS OF THE DIESEL COMBUSTION PROCESS AND ESTIMATED FUTURE DEVELOPMENT TRENDS

HS-017 524

NOISE, EMISSIONS AND PERFORMANCE OF THE DIESEL ENGINE. A COMPARISON BETWEEN DI [DIRECT INJECTION] AND IDI [INDIRECT INJECTION] COMBUSTION SYSTEMS

HS-017 529

PISTON SLAP NOISE OF INDIRECT COMBUSTION DIESEL ENGINE

HS-017 534

THE EFFECT OF COMBUSTION SYSTEM ON ENGINE NOISES

HS-017 531

COMMUNITY

COUNTERMEASURES--A COMMUNITY BASED CAMPAIGN FOR THE PREVENTION OF DRUNK DRIVING: AN EXPERIMENTAL EVALUATION

HS-017 560

COMPARATIVE

THE DEVELOPMENT AND COMPARATIVE EVALUATION OF ANALYTICAL TIRE MODELS FOR DYNAMIC VEHICLE SIMULATION. FINAL REPORT

HS-017 548

COMPARISON

NOISE, EMISSIONS AND PERFORMANCE OF THE DIESEL ENGINE. A COMPARISON BETWEEN DI [DIRECT INJECTION] AND IDI [INDIRECT INJECTION] COMBUSTION SYSTEMS

HS-017 529

COMPENDIUM

COMPENDIUM OF PEDESTRIAN-BICYCLE SAFETY PROGRAMS

HS-017 471

COMPLIANCE

CONSIDERATIONS IN THE USE OF SAMPLING PLANS FOR EFFECTING COMPLIANCE WITH MANDATORY SAFETY STANDARDS. FINAL REPORT

HS-017 426

COMPOUNDS

IDENTIFICATION OF ELASTOMERS IN TIRE SECTIONS BY TOTAL THERMAL ANALYSIS. 2. WHITE SIDEWALL COMPOUNDS OF EPDM AND BLENDS

HS-017 549

IDENTIFICATION OF ELASTOMERS IN TIRE SECTIONS BY TOTAL THERMAL ANALYSIS. 3. WHITE

COMPULSORY

THE INTRODUCTION OF COMPULSORY SEAT BELT WEARING LAWS IN AUSTRALIA AND THEIR EFFECT

HS-017 556

COMPUTER

AUTOMOTIVE OCCUPANT PROTECTIVE SAFETY AIR CUSHION %AIR BAG% EXPENDITURE/BENEFIT STUDY [APPENDIX I. COMPUTER RUN SUMMARY]

HS-017 475

EXPERIMENTAL AND COMPUTER SIMULATION EVALUATION OF HEADLAMP BEAMS

HS-017 457

COMPUTERIZED

METHODOLOGIES FOR THE EVALUATION AND IMPROVEMENT OF EMERGENCY MEDICAL SERVICE SYSTEMS. VOL. 3. COMPUTERIZED AMBULANCE LOCATION LOGIC USERS MANUAL: PL/I AND FORTRAN VERSIONS. FINAL REPORT

HS-801 705

CONCEPT

A UNIQUE CONCEPT FOR AUTOMATICALLY CONTROLLING THE BRAKING ACTION OF WHEELED VEHICLES DURING MINIMUM DISTANCE STOPS

HS-017 501

THE TEXACO IGNITION SYSTEM--A NEW CONCEPT FOR AUTOMOTIVE ENGINES

HS-017 583

CONFERENCE

DIESEL ENGINE NOISE CONFERENCE

HS-017 527

THE TRANSPORTATION INDUSTRY CONFERENCE ON INFLATION, LOS ANGELES, CALIFORNIA, SEPTEMBER 19-20, 1974

HS-017 505

TRAFFIC SAFETY. PROCEEDINGS OF THE SCIENTIFIC CONFERENCE, OTTAWA, ONTARIO, CANADA, MAY 23 AND 24, 1974

HS-017 559

TRANSPORTATION PROGRAMMING PROCESS. PROCEEDINGS OF A CONFERENCE, ORLANDO, FLORIDA, 23-26 MARCH 1975.

HS-017 482

CONGRESS

INTERNATIONAL CONGRESS ON AUTOMOTIVE SAFETY (4TH) PROCEEDINGS, JULY 14-16, 1975

HS-801 745

CONSPICUOUSNESS

DRIVER PERCEPTION OF PEDESTRIAN CONSPICUOUSNESS UNDER STANDARD HEADLIGHT [HEADLAMP] ILLUMINATION

HS-017 516

CONTEMPORARY

THE PROTECTIVE VALUE OF CONTEMPORARY MOTORCYCLE HELMETS IN THE PREVENTION OF HEAD INJURIES

HS-017 569

CONTROL

ANALYSIS OF DRIVER CONTROL MOVEMENTS ON
A LIMITED-ACCESS DIVIDED HIGHWAY

HS-017 489

DIESEL EMISSION CONTROL THROUGH RETROFITS

HS-017 444

RELATIONSHIP OF ACCIDENT PATTERNS TO TYPE
OF INTERSECTION CONTROL

HS-017 514

SPEED CONTROL IN RURAL SCHOOL ZONES

HS-017 577

CONTROLLER

AUTOMATIC VEHICLE CONTROLLER. OPERATOR'S
AND MAINTENANCE MANUAL

HS-801 716

CONTROLS

TEMPERATURE MEASUREMENT FOR ADVANCED
GAS TURBINE CONTROLS

HS-017 445

CONVICTED

EVALUATING THE EFFECTIVENESS OF REEDUCA-
TION PROGRAMS FOR CONVICTED [ALCOHOL] IM-
PAIRED DRIVERS

HS-017 458

COOPERATIVE

COOPERATIVE EVALUATION OF TECHNIQUES FOR
MEASURING NITRIC OXIDE AND CARBON MONOX-
IDE (PHASE 4 TESTS)

HS-017 443

CORNERING

TIRE CORNERING PROPERTIES

HS-017 495

CORROSION

EVALUATING THE EFFECTS OF CORROSION ON
STRUCTURAL MATERIALS. A STUDY OF PLAIN
CARBON AND HIGH STRENGTH LOW ALLOY
STEELS

HS-017 453

COST

TRAFFIC SAFETY '74. A REPORT ON ACTIVITIES
UNDER THE NATIONAL TRAFFIC AND MOTOR
VEHICLE SAFETY ACT OF 1966 AND THE MOTOR
VEHICLE INFORMATION AND COST SAVINGS ACT
OF 1972.

HS-801 700

COUNTERMEASURES

COUNTERMEASURES--A COMMUNITY BASED CAM-
PAIGN FOR THE PREVENTION OF DRUNK DRIVING:
AN EXPERIMENTAL EVALUATION

HS-017 560

SPILLED FUEL IGNITION SOURCES AND COUNTER-
MEASURES. FINAL REPORT

HS-801 722

SPILLED FUEL IGNITION SOURCES AND COUNTER-
MEASURES. SUMMARY REPORT. FINAL REPORT

HS-801 744

COUPLED

A CYBERNETICALLY COUPLED RESEARCH VEHI-

CRASH

CRASH CUSHIONS OF WASTE MATERIALS

HS-017 430

CRASH HELMETS FOR MOPED RIDERS

HS-017 431

FULL SCALE CRASH TESTS OF A TIRE-SAND INER-
TIA BARRIER. INTERIM REPORT

HS-017 462

INTERACTIONS OF OCCUPANT AGE, VEHICLE
WEIGHT, AND THE PROBABILITY OF DYING IN A
TWO-VEHICLE CRASH

HS-017 472

STATEMENT BEFORE THE NATIONAL HIGHWAY
TRAFFIC SAFETY ADMINISTRATION (NHTSA) AT
THE PUBLIC MEETING ON STANDARD NO. 208, OC-
CUPANT CRASH PROTECTION, HELD MAY 19, 1975

HS-017 506

CRASHES

COMMENTS ON ALCOHOL INVOLVEMENT IN
FATAL AND NON-FATAL CRASHES

HS-017 562

HUMAN FACTOR AND HARDWARE DESIGN CON-
SIDERATIONS FOR PASSENGER PROTECTION IN
HIGH SPEED CRASHES

HS-017 554

RESTRAINT USE AND EFFECTIVENESS IN REAL-
WORLD CRASHES; FEW CHILDREN PROTECTED IN
CARS; [AND] PAPERS RELEVANT TO FEDERAL
MOTOR VEHICLE SAFETY

HS-017 507

CRASHWORTHINESS

SUBCOMPACT CAR CRASHWORTHINESS PROGRAM.
PROGRESS REPORT FOR JUNE AND JULY, 1975

HS-801 723

SUBCOMPACT CAR CRASHWORTHINESS PROGRAM.
PROGRESS REPORT, AUGUST 1975

HS-801 749

CRC

CRC EVALUATION OF TECHNIQUES FOR MEASUR-
ING HYDROCARBONS IN DIESEL EXHAUST. PHASE
4

HS-017 442

CROSSWALKS

SPECIALIZED ILLUMINATION SYSTEMS FOR
PEDESTRIAN CROSSWALKS

HS-017 465

CUSHION

AUTOMOTIVE OCCUPANT PROTECTIVE SAFETY AIR
CUSHION [AIR BAG] EXPENDITURE/BENEFIT
STUDY

HS-017 476

AUTOMOTIVE OCCUPANT PROTECTIVE SAFETY AIR
CUSHION %AIR BAG% EXPENDITURE/BENEFIT
STUDY [APPENDIX I. COMPUTER RUN SUMMARY]

HS-017 475

CUSHIONS

CRASH CUSHIONS OF WASTE MATERIALS

HS-017 430

| | | | |
|--|------------|---|------------|
| A CYBERNETICALLY COUPLED RESEARCH VEHICLE [CCRV] | HS-017 451 | VEHICLE DIAGNOSTIC STATION | HS-017 433 |
| CYLINDER REDUCING THE TRANSMITTED VIBRATIONS FROM SINGLE CYLINDER ENGINES | HS-017 525 | DIESEL A LIGHT DUTY DIESEL FOR AMERICA? | HS-017 487 |
| DEAF TIPS ON CAR CARE AND SAFETY FOR DEAF DRIVERS | HS-801 757 | AFFECTING DIESEL ENGINE NOISE BY THE PISTON | HS-017 532 |
| DEATH DEATH AND INJURY ROAD ACCIDENTS IN NORTHERN IRELAND, 1974 | HS-017 436 | CRC EVALUATION OF TECHNIQUES FOR MEASURING HYDROCARBONS IN DIESEL EXHAUST. PHASE 4 | HS-017 442 |
| DEFECT MOTOR VEHICLE SAFETY DEFECT RECALL CAMPAIGNS--DETAILED REPORTS FROM APRIL 1 TO JUNE 30, 1975 | HS-801 662 | DESIGN CONCEPTS OF DIESEL ENGINES WITH LOW NOISE EMISSION | HS-017 543 |
| DEFECTS EARLY DETECTION OF DEFECTS IN ROLLING-ELEMENT BEARINGS | HS-017 448 | DIESEL EMISSION CONTROL THROUGH RETROFITS | HS-017 444 |
| DEFENSE ALCOHOL, HIGHWAY SAFETY AND THE DWI DEFENSE ATTORNEY. FINAL TECHNICAL REPORT | HS-801 732 | DIESEL ENGINE NOISE CONFERENCE | HS-017 527 |
| DELAYED DELAYED EFFECTS OF ACUTE ALCOHOLIC INTOXICATION ON PERFORMANCE WITH REFERENCE TO WORK SAFETY | HS-017 510 | EFFECT OF TURBOCHARGING ON DIESEL ENGINE NOISE, EMISSIONS AND PERFORMANCE | HS-017 530 |
| DERIVATIVE THERMOANALYTICAL METHODS IN VULCANIZATE ANALYSIS. 2. DERIVATIVE THERMOGRAVIMETRIC ANALYSIS | HS-017 552 | EMISSION FORMATION CHARACTERISTICS OF THE DIESEL COMBUSTION PROCESS AND ESTIMATED FUTURE DEVELOPMENT TRENDS | HS-017 524 |
| DESIGNERS NOISE--THE DIESEL ENGINE DESIGNERS' DILEMMA | HS-017 546 | EMISSIONS AND ECONOMY OF FOUR DIESEL CARS | HS-017 582 |
| DETECTION EARLY DETECTION OF DEFECTS IN ROLLING-ELEMENT BEARINGS | HS-017 448 | HIGHLY TURBOCHARGED SMALL AUTOMOTIVE DIESEL ENGINES | HS-017 580 |
| THE DEVELOPMENT OF TECHNOLOGY FOR DETECTION OF MARIJUANA INTOXICATION BY ANALYSIS OF BODY FLUIDS. FINAL REPORT | HS-801 721 | NOISE--THE DIESEL ENGINE DESIGNERS' DILEMMA | HS-017 546 |
| DI NOISE, EMISSIONS AND PERFORMANCE OF THE DIESEL ENGINE. A COMPARISON BETWEEN DI [DIRECT INJECTION] AND IDI [INDIRECT INJECTION] COMBUSTION SYSTEMS | HS-017 529 | NOISE, EMISSIONS AND PERFORMANCE OF THE DIESEL ENGINE. A COMPARISON BETWEEN DI [DIRECT INJECTION] AND IDI [INDIRECT INJECTION] COMBUSTION SYSTEMS | HS-017 529 |
| | | PISTON SLAP NOISE OF INDIRECT COMBUSTION DIESEL ENGINE | HS-017 534 |
| | | PRACTICAL MEANS FOR REDUCING THE NOISE OF FAST DIESEL ENGINES | HS-017 542 |
| | | SIMPLE MODEL TECHNIQUE FOR BETTER UNDERSTANDING OF DIESEL ENGINE VIBRATION AND NOISE | HS-017 539 |
| | | TECHNIQUES FOR QUIETING THE DIESEL | HS-017 544 |
| | | TECHNIQUES OF STRUCTURAL VIBRATION ANALYSIS APPLIED TO DIESEL ENGINE NOISE REDUCTION | HS-017 540 |
| | | THE APPLICATION OF IDEALIZATION AND RESPONSE ANALYSIS TO DIESEL ENGINE NOISE ASSESSMENT | HS-017 541 |
| | | THE LIGHT DUTY DIESEL ENGINE FOR PRIVATE TRANSPORTATION | HS-017 488 |

FLUENCE ON DIESEL PISTON DESIGN HS-017 533

DIFFERENCES

INTERINDIVIDUAL DIFFERENCES IN MESOPIC
NIGHT VISION ABILITY MEASURED BY THE
MESOPTOMETER HS-017 481

DILEMMA

NOISE--THE DIESEL ENGINE DESIGNERS' DILEMMA
HS-017 546

DIRECT

NOISE, EMISSIONS AND PERFORMANCE OF THE
DIESEL ENGINE. A COMPARISON BETWEEN DI
[DIRECT INJECTION] AND IDI [INDIRECT INJECTION]
COMBUSTION SYSTEMS HS-017 529

DISPLAY

THREE-DIMENSIONAL HUMAN DISPLAY MODEL
HS-017 556

DISPLAYS

AUTOMOTIVE SOLID STATE DISPLAYS
HS-017 579

DISTANCE

A UNIQUE CONCEPT FOR AUTOMATICALLY CONTROLLING
THE BRAKING ACTION OF WHEELED VEHICLES DURING
MINIMUM DISTANCE STOPS HS-017 501

DIVIDED

ANALYSIS OF DRIVER CONTROL MOVEMENTS ON
A LIMITED-ACCESS DIVIDED HIGHWAY HS-017 489

DODGING

DWI PROGRAMS: DOING WHAT'S IN OR DODGING
WHAT'S INDICATED? HS-017 512

DOING

DWI PROGRAMS: DOING WHAT'S IN OR DODGING
WHAT'S INDICATED? HS-017 512

DOOR

DEVELOPMENT OF LIGHTWEIGHT DOOR INTRUSION
BEAMS UTILIZING AN ULTRA HIGH STRENGTH STEEL
HS-017 486

DRIVER

AN EVALUATION OF DRIVER SIMULATORS FOR
SAFETY TRAINING HS-017 508

ANALYSIS OF DRIVER CONTROL MOVEMENTS ON
A LIMITED-ACCESS DIVIDED HIGHWAY HS-017 489

DESIGN AND IMPLEMENTATION OF A SYSTEM TO
RECORD DRIVER LATERAL POSITIONING HS-017 574

SPECIFICITY UNDER STANDARD HEADLAMP ILLUMINATION
HS-017 5

DRIVER PERFORMANCE RELATED TO THE VEHICLE
CLE HS-017 5

DRIVER RECALL OF ROADSIDE SIGNS
HS-017 4

**DRIVER RESPONSE TO THE 55 MPH MAXIMUM
SPEED LIMIT AND THE VARIATIONAL CHARACTERISTICS
OF SPOT SPEEDS**
HS-017 4

DRIVER ROAD SIGN INTERACTION
HS-017 5

**EFFECT OF PASSENGER LOADING ON DRIVER
VISIBILITY [FIELD OF VIEW] FROM AUTOMOBILES**
HS-801 7

**EFFECTS OF INCREASED ENFORCEMENT AT
URBAN INTERSECTIONS ON DRIVER BEHAVIOR
AND SAFETY**
HS-017 5

**METHODS OF MEASURING DRIVER BEHAVIOR
[BEHAVIOR]**
HS-017 5

**MOTORCYCLE TRAINING FOR CALIFORNIA DRIVER
LICENSING PERSONNEL. FINAL REPORT**
HS-017 4

DRIVER/VEHICLE

EFFECTS OF INTERMIXING OF BIAS, BIAS BELT
AND RADIAL PLY PASSENGER TIRES ON VEHICLE
DYNAMICS AND DRIVER/VEHICLE RESPONSE
FINAL REPORT HS-801 7

DRIVERS

EVALUATING THE EFFECTIVENESS OF REEDUCATION
PROGRAMS FOR CONVICTED [ALCOHOL] IMPAIRED
DRIVERS HS-017 4

**EYE FIXATIONS OF DRIVERS IN NIGHT DRIVING
WITH THREE HEADLIGHT [HEADLAMP] BEAM
FINAL REPORT**
HS-017 5

**TIPS ON CAR CARE AND SAFETY FOR DEAF
DRIVERS**
HS-801 7

DRIVING

COMMERCIAL DRIVING SCHOOL INSTRUCTOR
PROJECT AT OHLONE COLLEGE. FINAL REPORT
HS-801 7

COUNTERMEASURES--A COMMUNITY BASED CAMPAIGN
FOR THE PREVENTION OF DRUNK DRIVING
AN EXPERIMENTAL EVALUATION HS-017 5

DRUGS (OTHER THAN ALCOHOL) AND DRIVING
HS-017 5

**EYE FIXATIONS OF DRIVERS IN NIGHT DRIVING
WITH THREE HEADLIGHT [HEADLAMP] BEAM
FINAL REPORT**
HS-017 5

- THE PERCEPTION OF MANOEUVRES [MANOEUVRES] OF MOVING VEHICLES. PROGRESS REPORT NO. 6. IMPLICATIONS OF PSYCHOPHYSICAL THRESHOLD MEASUREMENT FOR THE NIGHT DRIVING SITUATION. FINAL REPORT
HS-017 470
- DRUGS**
DRUGS (OTHER THAN ALCOHOL) AND DRIVING
HS-017 561
- DRUNK**
COUNTERMEASURES--A COMMUNITY BASED CAMPAIGN FOR THE PREVENTION OF DRUNK DRIVING: AN EXPERIMENTAL EVALUATION
HS-017 560
- DUTY**
A LIGHT DUTY DIESEL FOR AMERICA?
HS-017 487
THE LIGHT DUTY DIESEL ENGINE FOR PRIVATE TRANSPORTATION
HS-017 488
- DWI**
ALCOHOL, HIGHWAY SAFETY AND THE DWI DEFENSE ATTORNEY. FINAL TECHNICAL REPORT.
HS-801 732
DWI PROGRAMS: DOING WHAT'S IN OR DODGING WHAT'S INDICATED?
HS-017 512
POLICE MANAGEMENT TRAINING. FACTORS INFLUENCING DWI ARRESTS. FINAL TECHNICAL REPORT
HS-801 731
- DYING**
INTERACTIONS OF OCCUPANT AGE, VEHICLE WEIGHT, AND THE PROBABILITY OF DYING IN A TWO-VEHICLE CRASH
HS-017 472
- DYNAMIC**
THE DEVELOPMENT AND COMPARATIVE EVALUATION OF ANALYTICAL TIRE MODELS FOR DYNAMIC VEHICLE SIMULATION. FINAL REPORT
HS-017 548
- DYNAMICS**
EFFECTS OF INTERMIXING OF BIAS, BIAS BELTED, AND RADIAL PLY PASSENGER TIRES ON VEHICLE DYNAMICS AND DRIVER/VEHICLE RESPONSES. FINAL REPORT
HS-801 702
- EARLY**
EARLY DETECTION OF DEFECTS IN ROLLING-ELEMENT BEARINGS
HS-017 448
- ECONOMICS**
ENERGY ECONOMICS OF AUTOMOTIVE POWER GENERATION
HS-017 513
- ECONOMY**
EMISSIONS AND ECONOMY OF FOUR DIESEL CARS
HS-017 582
- TEST VARIABILITY OF EMISSION AND FUEL ECONOMY MEASUREMENTS USING THE 1975 FEDERAL TEST PROCEDURE
HS-017 437
- THE EFFECT OF AUTOMATIC TRANSMISSIONS ON MILITARY TRUCK FUEL ECONOMY
HS-017 450
- EFFECTING**
CONSIDERATIONS IN THE USE OF SAMPLING PLANS FOR EFFECTING COMPLIANCE WITH MANDATORY SAFETY STANDARDS. FINAL REPORT
HS-017 426
- ELASTOMERS**
IDENTIFICATION OF ELASTOMERS IN TIRE SECTIONS BY TOTAL THERMAL ANALYSIS. 2. WHITE SIDEWALL COMPOUNDS OF EPDM AND BLENDS
HS-017 549
IDENTIFICATION OF ELASTOMERS IN TIRE SECTIONS BY TOTAL THERMAL ANALYSIS. 3. WHITE SIDEWALL COMPOUNDS OF NEOPRENE RUBBER BLENDS
HS-017 550
IDENTIFICATION OF ELASTOMERS IN TIRE SECTIONS BY TOTAL THERMAL ANALYSIS. 4. INNER-LINER
HS-017 551
- ELECTRIC**
ELECTRIC CARS
HS-017 479
- EMERGENCY**
AN EVALUATION METHODOLOGY FOR EMERGENCY MEDICAL SERVICES
HS-017 571
METHODOLOGIES FOR THE EVALUATION AND IMPROVEMENT OF EMERGENCY MEDICAL SERVICE SYSTEMS. VOL. 2. APPENDICES. FINAL REPORT
HS-801 704
METHODOLOGIES FOR THE EVALUATION AND IMPROVEMENT OF EMERGENCY MEDICAL SERVICE SYSTEMS. VOL. 3. COMPUTERIZED AMBULANCE LOCATION LOGIC USERS MANUAL: PL/I AND FORTRAN VERSIONS. FINAL REPORT
HS-801 705
QUALITY MEASUREMENT OF EMERGENCY MEDICAL CARE
HS-017 572
- EMISSION**
DESIGN CONCEPTS OF DIESEL ENGINES WITH LOW NOISE EMISSION
HS-017 543
DIESEL EMISSION CONTROL THROUGH RETROFITS
HS-017 444
EMISSION FORMATION CHARACTERISTICS OF THE DIESEL COMBUSTION PROCESS AND ESTIMATED FUTURE DEVELOPMENT TRENDS
HS-017 524
TEST VARIABILITY OF EMISSION AND FUEL ECONOMY MEASUREMENTS USING THE 1975 FEDERAL TEST PROCEDURE
HS-017 437

EMISSIONS

COMBUSTION PROCESS FUNDAMENTALS AND COMBUSTION CHAMBER DESIGN FOR LOW EMISSIONS

HS-017 523

EFFECT OF TURBOCHARGING ON DIESEL ENGINE NOISE, EMISSIONS AND PERFORMANCE

HS-017 530

EMISSIONS AND ECONOMY OF FOUR DIESEL CARS

HS-017 582

NOISE, EMISSIONS AND PERFORMANCE OF THE DIESEL ENGINE. A COMPARISON BETWEEN DI [DIRECT INJECTION] AND IDI [INDIRECT INJECTION] COMBUSTION SYSTEMS

HS-017 529

ENCLOSED

PASSENGER NOISE ENVIRONMENTS OF ENCLOSED TRANSPORTATION SYSTEMS

HS-017 521

ENERGY

ACCIDENT CHANGES UNDER ENERGY CRISIS. REPORT ON ACCIDENT REDUCTION VARIABLES

HS-017 480

DE LOREAN REPORT TO FEDERAL ENERGY ADMINISTRATION SAYS FUEL SAVING CARS NEED AIR BAGS [NEWS RELEASE]

HS-017 474

EFFECTS OF THE ENERGY CRISIS AND 55 MPH SPEED LIMIT IN MICHIGAN. FINAL REPORT

HS-017 463

ENERGY ECONOMICS OF AUTOMOTIVE POWER GENERATION

HS-017 513

ENFORCEMENT

EFFECTS OF INCREASED ENFORCEMENT AT URBAN INTERSECTIONS ON DRIVER BEHAVIOR AND SAFETY

HS-017 515

STANDARDS ENFORCEMENT TEST REPORTS INDEX FOR 1973

HS-801 663

ENGINE

AFFECTING DIESEL ENGINE NOISE BY THE PISTON

HS-017 532

ANALYSIS AND PREDICTION OF ENGINE STRUCTURE VIBRATION

HS-017 537

DIESEL ENGINE NOISE CONFERENCE

HS-017 527

EFFECT OF TURBOCHARGING ON DIESEL ENGINE NOISE, EMISSIONS AND PERFORMANCE

HS-017 530

ENGINEERING KNOW-HOW IN ENGINE DESIGN. PART 23. ENGINE DESIGN TO MEET NEW SOCIAL OBLIGATIONS

HS-017 522

INJECTION NOISE AND ITS RELATION TO FUEL PUMP AND ENGINE NOISE

HS-017 535

LOW NOISE OPPOSED PISTON TWO-STROKE ENGINE AND BLOWER

HS-017

MODES OF ENGINE STRUCTURE VIBRATION AS SOURCE OF NOISE

HS-017

NOISE--THE DIESEL ENGINE DESIGNERS' DILEMMA

HS-017

NOISE, EMISSIONS AND PERFORMANCE OF DIESEL ENGINE. A COMPARISON BETWEEN [DIRECT INJECTION] AND IDI [INDIRECT INJECTION] COMBUSTION SYSTEMS

HS-017

PISTON SLAP NOISE OF INDIRECT COMBUSTION DIESEL ENGINE

HS-017

SIMPLE MODEL TECHNIQUE FOR BETTER UNDERSTANDING OF DIESEL ENGINE VIBRATION AND NOISE

HS-017

TECHNIQUES OF STRUCTURAL VIBRATION ANALYSIS APPLIED TO DIESEL ENGINE NOISE REDUCTION

HS-017

THE APPLICATION OF IDEALIZATION AND RESPONSE ANALYSIS TO DIESEL ENGINE NOISE ASSESSMENT

HS-017

THE EFFECT OF COMBUSTION SYSTEM ON ENGINE NOISES

HS-017

THE LIGHT DUTY DIESEL ENGINE FOR PRIVATE TRANSPORTATION

HS-017

ENGINES

DESIGN CONCEPTS OF DIESEL ENGINES WITH LOW NOISE EMISSION

HS-017

HIGHLY TURBOCHARGED SMALL AUTOMOTIVE DIESEL ENGINES

HS-017

PRACTICAL MEANS FOR REDUCING THE NOISE OF FAST DIESEL ENGINES

HS-017

PRECHAMBER AND VALVE GEAR DESIGN FOR VALVE STRATIFIED CHARGE ENGINES

HS-017

REDUCING THE TRANSMITTED VIBRATIONS FROM SINGLE CYLINDER ENGINES

HS-017

TEMPERATURE MEASUREMENT FOR GAS TURBINE ENGINES

HS-017

THE PROBLEMS OF NOISE OF ENGINES IN DIFFERENT VEHICLE GROUPS

HS-017

THE TEXACO IGNITION SYSTEM--A NEW CONCEPT FOR AUTOMOTIVE ENGINES

HS-017

ENVIRONMENTS

ASSESSMENT OF PEDESTRIAN ATTITUDES AND BEHAVIOR IN SUBURBAN ENVIRONMENTS

HS-017 517

PASSENGER NOISE ENVIRONMENTS OF ENCLOSED TRANSPORTATION SYSTEMS

HS-017 521

EPDM

IDENTIFICATION OF ELASTOMERS IN TIRE SECTIONS BY TOTAL THERMAL ANALYSIS. 2. WHITE SIDEWALL COMPOUNDS OF EPDM AND BLENDS

HS-017 549

ESTIMATE

STATEWIDE HIGHWAY SAFETY PROGRAM ASSESSMENT. A NATIONAL ESTIMATE OF PERFORMANCE. JULY, 1975

HS-801 742

EUROPEAN

EUROPEAN APPROACH TO THE LUMINANCE ASPECT OF ROADWAY LIGHTING

HS-017 467

EXDUCER

PERFORMANCE AND APPLICATION OF THE EXDUCER POWER TURBINE

HS-017 447

EXHAUST

CRC EVALUATION OF TECHNIQUES FOR MEASURING HYDROCARBONS IN DIESEL EXHAUST. PHASE 4

HS-017 442

EXPENDITURE/BENEFIT

AUTOMOTIVE OCCUPANT PROTECTIVE SAFETY AIR CUSHION %AIR BAG% EXPENDITURE/BENEFIT STUDY [APPENDIX I. COMPUTER RUN SUMMARY]

HS-017 475

AUTOMOTIVE OCCUPANT PROTECTIVE SAFETY AIR CUSHION [AIR BAG] EXPENDITURE/BENEFIT STUDY

HS-017 476

EXTRUSION

PRACTICAL APPLICATION OF FORWARD EXTRUSION THEORY

HS-017 439

EYE

EYE FIXATIONS OF DRIVERS IN NIGHT DRIVING WITH THREE HEADLIGHT [HEADLAMP] BEAMS. FINAL REPORT

HS-017 547

FAST

PRACTICAL MEANS FOR REDUCING THE NOISE OF FAST DIESEL ENGINES

HS-017 542

FATAL

COMMENTS ON ALCOHOL INVOLVEMENT IN FATAL AND NON-FATAL CRASHES

HS-017 562

FATALITIES

FACTORS CONTRIBUTING TO THE REDUCTION OF MOTOR VEHICLE FATALITIES IN 1974

HS-017 509

FATIGUE

EFFECTS OF GRAPHITE MORPHOLOGY, MATRIX HARDNESS, AND STRUCTURE ON THE FATIGUE RESISTANCE OF GRAY CAST IRON

HS-017 441

FEDERAL

DE LOREAN REPORT TO FEDERAL ENERGY ADMINISTRATION SAYS FUEL SAVING CARS NEED AIR BAGS [NEWS RELEASE]

HS-017 474

RESTRAINT USE AND EFFECTIVENESS IN REAL-WORLD CRASHES; FEW CHILDREN PROTECTED IN CARS; [AND] PAPERS RELEVANT TO FEDERAL MOTOR VEHICLE SAFETY

HS-017 507

TEST VARIABILITY OF EMISSION AND FUEL ECONOMY MEASUREMENTS USING THE 1975 FEDERAL TEST PROCEDURE

HS-017 437

FIRE

HIGHWAY ACCIDENT REPORT. GEORGE WOLLMAN MEATS, INC., TRUCK/AUTO/GREYHOUND BUS COLLISION AND FIRE, NEW JERSEY TURNPIKE, BORDENTOWN, NEW JERSEY, OCTOBER 19, 1973

HS-017 491

FIXATIONS

EYE FIXATIONS OF DRIVERS IN NIGHT DRIVING WITH THREE HEADLIGHT [HEADLAMP] BEAMS. FINAL REPORT

HS-017 547

FLANGE

SHEET METAL STRETCH FLANGE ANALYSIS: A MANUFACTURING VIEWPOINT

HS-017 440

FLORIDA

MOTOR CARRIER ACCIDENT INVESTIGATION. WARE OIL AND SUPPLY CO., INC. ACCIDENT-- MARCH 1, 1975--PERRY, FLORIDA

HS-017 478

TRAFFIC ACCIDENT FACTS, 1974 [FLORIDA]. AN ILLUSTRATED ANALYSIS OF ACCIDENT RECORDS

HS-017 473

TRANSPORTATION PROGRAMMING PROCESS. PROCEEDINGS OF A CONFERENCE, ORLANDO, FLORIDA, 23-26 MARCH 1975.

HS-017 482

FLOWING

EFFECT OF 55-MPH SPEED LIMIT ON AVERAGE SPEEDS OF FREE-FLOWING AUTOMOBILES ON AN INTERSTATE BRIDGE IN WEST VIRGINIA

HS-017 575

FLUIDS

THE DEVELOPMENT OF TECHNOLOGY FOR DETECTION OF MARIJUANA INTOXICATION BY ANALYSIS OF BODY FLUIDS. FINAL REPORT

HS-801 721

| | | | |
|--|------------|--|------------|
| TESTING OF FOREIGN PROTOTYPE EXPERIMENTAL SAFETY VEHICLES--PROGRAM SUMMARY REPORT. FINAL REPORT | HS-801 717 | MEASURES. FINAL REPORT | HS-801 722 |
| FORMATION | | SPILLED FUEL IGNITION SOURCES AND COUNTER-MEASURES. SUMMARY REPORT. FINAL REPORT | HS-801 744 |
| EMISSION FORMATION CHARACTERISTICS OF THE DIESEL COMBUSTION PROCESS AND ESTIMATED FUTURE DEVELOPMENT TRENDS | HS-017 524 | TEST VARIABILITY OF EMISSION AND FUEL ECONOMY MEASUREMENTS USING THE 1975 FEDERAL TEST PROCEDURE | HS-017 437 |
| FORTRAN | | THE EFFECT OF AUTOMATIC TRANSMISSIONS ON MILITARY TRUCK FUEL ECONOMY | HS-017 450 |
| METHODOLOGIES FOR THE EVALUATION AND IMPROVEMENT OF EMERGENCY MEDICAL SERVICE SYSTEMS. VOL. 3. COMPUTERIZED AMBULANCE LOCATION LOGIC USERS MANUAL: PL/I AND FORTRAN VERSIONS. FINAL REPORT | HS-801 705 | THE EFFECT OF THE FUEL SHORTAGE ON TRAVEL AND HIGHWAY SAFETY | HS-801 715 |
| FORWARD | | FULL | |
| PRACTICAL APPLICATION OF FORWARD EXTRUSION THEORY | HS-017 439 | FULL SCALE CRASH TESTS OF A TIRE-SAND INERTIA BARRIER. INTERIM REPORT | HS-017 462 |
| FREE | | FUNCTION | |
| EFFECT OF 55-MPH SPEED LIMIT ON AVERAGE SPEEDS OF FREE-FLOWING AUTOMOBILES ON AN INTERSTATE BRIDGE IN WEST VIRGINIA | HS-017 575 | TIRE-PAVEMENT FRICTION AS A FUNCTION OF VEHICLE MANEUVERS. FINAL REPORT | HS-017 427 |
| FREEWAY | | FUNDAMENTALS | |
| CAPACITY ANALYSIS TECHNIQUES FOR DESIGN AND OPERATION OF FREEWAY FACILITIES. FINAL REPORT | HS-017 520 | COMBUSTION PROCESS FUNDAMENTALS AND COMBUSTION CHAMBER DESIGN FOR LOW EMISSIONS | HS-017 523 |
| FREQUENCIES | | GAS | |
| REAR-IMPACTED VEHICLE COLLISIONS: FREQUENCIES AND CASUALTY PATTERNS. FINAL REPORT | HS-017 461 | TEMPERATURE MEASUREMENT FOR ADVANCED GAS TURBINE CONTROLS | HS-017 445 |
| FRICTION | | TEMPERATURE MEASUREMENT FOR GAS TURBINE ENGINES | HS-017 446 |
| TIRE-PAVEMENT FRICTION AS A FUNCTION OF VEHICLE MANEUVERS. FINAL REPORT | HS-017 427 | GAZ | |
| FRONT | | METHOD OF CHECKING AND ADJUSTING BRAKES OF THE GAZ-21 ON THE BASIS OF BRAKING TIME | HS-017 455 |
| ADVANCED PASSIVE RESTRAINT SYSTEM FOR SUBCOMPACT SIZE VEHICLE FRONT SEAT PASSENGERS. PROGRESS REPORTS 14 AND 15, 4 AUGUST 1975 TO 5 OCTOBER 1975 | HS-801 752 | GEAR | |
| THE STRUGGLE OVER WHAT'S UP FRONT [THE ARGUMENT ABOUT FRONT AXLE WEIGHT MAXIMUM] | HS-017 576 | PRECHAMBER AND VALVE GEAR DESIGN FOR 3-VALVE STRATIFIED CHARGE ENGINES | HS-017 526 |
| FUEL | | GENERATION | |
| DE LOREAN REPORT TO FEDERAL ENERGY ADMINISTRATION SAYS FUEL SAVING CARS NEED AIR BAGS [NEWS RELEASE] | HS-017 474 | A NOTE ON HEAT GENERATION DUE TO SURFACE RUBBING | HS-017 497 |
| IDENTIFICATION AND MODELING OF ROTARY FUEL INJECTION PUMP NOISE PROCESSES | HS-017 536 | ENERGY ECONOMICS OF AUTOMOTIVE POWER GENERATION | HS-017 513 |
| INJECTION NOISE AND ITS RELATION TO FUEL PUMP AND ENGINE NOISE | HS-017 535 | GENERATIONS | |
| | | THREE GENERATIONS OF SOVIET WHEELED MILITARY TRANSPORT VEHICLES | HS-017 452 |
| | | GEOMETRICS | |
| | | RELATIONSHIPS BETWEEN ROADWAY GEOMETRICS AND ACCIDENTS | HS-017 578 |

MEATS, INC., TRUCK/AUTO/GREYHOUND BUS COLLISION AND FIRE, NEW JERSEY TURNPIKE, BORDENTOWN, NEW JERSEY, OCTOBER 19, 1973
 HS-017 491

GLARE
 EVALUATION OF GLARE REDUCTION TECHNIQUES. FINAL REPORT
 HS-801 718

GOALS
 PROBLEMS, PROGRESS AND GOALS IN TRAFFIC SAFETY [PANEL DISCUSSION]
 HS-017 573

GRADING
 UNIFORM TIRE QUALITY GRADING--TREADWEAR. CITY TEST. FINAL REPORT
 HS-801 735

GRAPHITE
 EFFECTS OF GRAPHITE MORPHOLOGY, MATRIX HARDNESS, AND STRUCTURE ON THE FATIGUE RESISTANCE OF GRAY CAST IRON
 HS-017 441

GRAY
 EFFECTS OF GRAPHITE MORPHOLOGY, MATRIX HARDNESS, AND STRUCTURE ON THE FATIGUE RESISTANCE OF GRAY CAST IRON
 HS-017 441

HARDNESS
 EFFECTS OF GRAPHITE MORPHOLOGY, MATRIX HARDNESS, AND STRUCTURE ON THE FATIGUE RESISTANCE OF GRAY CAST IRON
 HS-017 441

HARDWARE
 HUMAN FACTOR AND HARDWARE DESIGN CONSIDERATIONS FOR PASSENGER PROTECTION IN HIGH SPEED CRASHES
 HS-017 554

HEAD
 THE PROTECTIVE VALUE OF CONTEMPORARY MOTORCYCLE HELMETS IN THE PREVENTION OF HEAD INJURIES
 HS-017 569

HEADLAMP
 DRIVER PERCEPTION OF PEDESTRIAN CONSPICUOUSNESS UNDER STANDARD HEADLIGHT [HEADLAMP] ILLUMINATION
 HS-017 516
 EXPERIMENTAL AND COMPUTER SIMULATION EVALUATION OF HEADLAMP BEAMS
 HS-017 457
 EYE FIXATIONS OF DRIVERS IN NIGHT DRIVING WITH THREE HEADLIGHT [HEADLAMP] BEAMS. FINAL REPORT
 HS-017 547

HEADLAMPS
 MEASURED ILLUMINATION CHARACTERISTICS OF THE 1974 HEADLAMPS. PART 1. THE S.A.E. HEADLAMPS
 HS-017 555

DRIVER PERCEPTION OF PEDESTRIAN CONSPICUOUSNESS UNDER STANDARD HEADLIGHT [HEADLAMP] ILLUMINATION
 HS-017 516
 EYE FIXATIONS OF DRIVERS IN NIGHT DRIVING WITH THREE HEADLIGHT [HEADLAMP] BEAMS. FINAL REPORT
 HS-017 547

HEARING
 STATEMENT OF THE STATE OF ILLINOIS IN RESPONSE TO THE HIGHWAY SAFETY SANCTION HEARING, WASHINGTON, D.C., SEPTEMBER 30, 1975
 HS-017 502

HEAT
 A NOTE ON HEAT GENERATION DUE TO SURFACE RUBBING
 HS-017 497

HELMETS
 CRASH HELMETS FOR MOPED RIDERS
 HS-017 431
 THE PROTECTIVE VALUE OF CONTEMPORARY MOTORCYCLE HELMETS IN THE PREVENTION OF HEAD INJURIES
 HS-017 569

HIGH
 DEVELOPMENT OF LIGHTWEIGHT DOOR INTRUSION BEAMS UTILIZING AN ULTRA HIGH STRENGTH STEEL
 HS-017 486
 EVALUATING THE EFFECTS OF CORROSION ON STRUCTURAL MATERIALS. A STUDY OF PLAIN CARBON AND HIGH STRENGTH LOW ALLOY STEELS
 HS-017 453
 HIGH STRENGTH MATERIALS AND VEHICLE WEIGHT REDUCTION ANALYSIS
 HS-017 485
 HUMAN FACTOR AND HARDWARE DESIGN CONSIDERATIONS FOR PASSENGER PROTECTION IN HIGH SPEED CRASHES
 HS-017 554

HIGHLY
 HIGHLY TURBOCHARGED SMALL AUTOMOTIVE DIESEL ENGINES
 HS-017 580

HIGHWAY
 ALCOHOL, HIGHWAY SAFETY AND THE DWI DEFENSE ATTORNEY. FINAL TECHNICAL REPORT
 HS-801 732
 ANALYSIS OF DRIVER CONTROL MOVEMENTS ON A LIMITED-ACCESS DIVIDED HIGHWAY
 HS-017 489
 ANALYSIS OF METHODOLOGY FOR MEASURING NATIONAL HIGHWAY TRAFFIC SAFETY. FINAL REPORT
 HS-801 741
 HIGHWAY ACCIDENT REPORT. GEORGE WOLLMAN MEATS, INC., TRUCK/AUTO/GREYHOUND BUS COLLISION AND FIRE, NEW JERSEY TURNPIKE, BORDENTOWN, NEW JERSEY, OCTOBER 19, 1973

LISION AND FIRE, NEW JERSEY TURNPIKE, BORDENTOWN, NEW JERSEY, OCTOBER 19, 1973

HS-017 491

HIGHWAY METRICATION. VOL. 1. TASKS 1, 2, 3, 4, AND APERCU. FINAL REPORT

HS-017 483

HIGHWAY METRICATION. VOL. 2. APPENDIXES. FINAL REPORT

HS-017 484

STATEMENT BEFORE THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA) AT THE PUBLIC MEETING ON STANDARD NO. 208, OCCUPANT CRASH PROTECTION, HELD MAY 19, 1975

HS-017 506

STATEMENT OF THE STATE OF ILLINOIS IN RESPONSE TO THE HIGHWAY SAFETY SANCTION HEARING, WASHINGTON, D.C., SEPTEMBER 30, 1975

HS-017 502

STATEWIDE HIGHWAY SAFETY PROGRAM ASSESSMENT. A NATIONAL ESTIMATE OF PERFORMANCE. JULY, 1975

HS-801 742

THE EFFECT OF THE FUEL SHORTAGE ON TRAVEL AND HIGHWAY SAFETY

HS-801 715

TRAFFIC SAFETY '74. A REPORT ON ACTIVITIES UNDER THE HIGHWAY SAFETY ACT OF 1966

HS-801 699

HIGHWAYS

CHILDREN AS PASSENGERS IN AUTOMOBILES: THE NEGLECTED MINORITY ON THE NATION'S HIGHWAYS

HS-017 493

HUMAN

HUMAN FACTOR AND HARDWARE DESIGN CONSIDERATIONS FOR PASSENGER PROTECTION IN HIGH SPEED CRASHES

HS-017 554

OCCUPANT MODEL FOR HUMAN MOTION

HS-017 434

THREE-DIMENSIONAL HUMAN DISPLAY MODEL

HS-017 556

HYDROCARBONS

CRC EVALUATION OF TECHNIQUES FOR MEASURING HYDROCARBONS IN DIESEL EXHAUST. PHASE 4

HS-017 442

IDEALIZATION

THE APPLICATION OF IDEALIZATION AND RESPONSE ANALYSIS TO DIESEL ENGINE NOISE ASSESSMENT

HS-017 541

IDENTIFICATION

IDENTIFICATION AND MODELING OF ROTARY FUEL INJECTION PUMP NOISE PROCESSES

HS-017 536

IDENTIFICATION OF ELASTOMERS IN TIRE SECTIONS BY TOTAL THERMAL ANALYSIS. 2. WHITE SIDEWALL COMPOUNDS OF EPDM AND BLENDS

HS-017 549

IDENTIFICATION OF ELASTOMERS IN TIRE SECTIONS BY TOTAL THERMAL ANALYSIS. 3. WHITE SIDEWALL COMPOUNDS OF NEOPRENE RUBBER BLENDS

HS-017 550

IDENTIFICATION OF ELASTOMERS IN TIRE SECTIONS BY TOTAL THERMAL ANALYSIS. 4. INNER-LINER

HS-017 551

IDI

NOISE, EMISSIONS AND PERFORMANCE OF THE DIESEL ENGINE. A COMPARISON BETWEEN DI [DIRECT INJECTION] AND IDI [INDIRECT INJECTION] COMBUSTION SYSTEMS

HS-017 529

IGNITION

SPILLED FUEL IGNITION SOURCES AND COUNTER-MEASURES. FINAL REPORT

HS-801 722

SPILLED FUEL IGNITION SOURCES AND COUNTER-MEASURES. SUMMARY REPORT. FINAL REPORT

HS-801 744

THE TEXACO IGNITION SYSTEM--A NEW CONCEPT FOR AUTOMOTIVE ENGINES

HS-017 583

ILLINOIS

STATEMENT OF THE STATE OF ILLINOIS IN RESPONSE TO THE HIGHWAY SAFETY SANCTION HEARING, WASHINGTON, D.C., SEPTEMBER 30, 1975

HS-017 502

ILLUMINATION

DRIVER PERCEPTION OF PEDESTRIAN CONSPICUOUSNESS UNDER STANDARD HEADLIGHT [HEADLAMP] ILLUMINATION

HS-017 516

MEASURED ILLUMINATION CHARACTERISTICS OF THE 1974 HEADLAMPS. PART 1. THE S.A.E. HEADLAMPS

HS-017 555

ROADWAY SIGN ILLUMINATION

HS-017 468

SPECIALIZED ILLUMINATION SYSTEMS FOR PEDESTRIAN CROSSWALKS

HS-017 465

IMPACT

THE NEW AIR BRAKE SYSTEMS--AN IMPACT OVERVIEW

HS-017 558

THORACIC IMPACT INJURY MECHANISM. VOL. 1. FINAL REPORT

HS-801 710

THORACIC IMPACT INJURY MECHANISM. VOL. 2. [APPENDICES.] FINAL REPORT

HS-801 711

IMPACTED

REAR-IMPACTED VEHICLE COLLISIONS: FREQUENCIES AND CASUALTY PATTERNS. FINAL REPORT

HS-017 461

| | |
|---|------------|
| IMPAIRED EVALUATING THE EFFECTIVENESS OF REEDUCATION PROGRAMS FOR CONVICTED [ALCOHOL] IMPAIRED DRIVERS | HS-017 458 |
| IMPLEMENTATION DESIGN AND IMPLEMENTATION OF A SYSTEM TO RECORD DRIVER LATERAL POSITIONING | HS-017 574 |
| IMPLICATIONS THE PERCEPTION OF MANOEUVRES [MANEUVERS] OF MOVING VEHICLES. PROGRESS REPORT NO. 6. IMPLICATIONS OF PSYCHOPHYSICAL THRESHOLD MEASUREMENT FOR THE NIGHT DRIVING SITUATION. FINAL REPORT | HS-017 470 |
| INDEX STANDARDS ENFORCEMENT TEST REPORTS INDEX FOR 1973 | HS-801 663 |
| INDICATED DWI PROGRAMS: DOING WHAT'S IN OR DODGING WHAT'S INDICATED? | HS-017 512 |
| INDIRECT NOISE, EMISSIONS AND PERFORMANCE OF THE DIESEL ENGINE. A COMPARISON BETWEEN DI [DIRECT INJECTION] AND IDI [INDIRECT INJECTION] COMBUSTION SYSTEMS | HS-017 529 |
| PISTON SLAP NOISE OF INDIRECT COMBUSTION DIESEL ENGINE | HS-017 534 |
| INDUSTRY THE TRANSPORTATION INDUSTRY CONFERENCE ON INFLATION, LOS ANGELES, CALIFORNIA, SEPTEMBER 19-20, 1974 | HS-017 505 |
| INERTIA FULL SCALE CRASH TESTS OF A TIRE-SAND INERTIA BARRIER. INTERIM REPORT | HS-017 462 |
| INFLATABLE INFLATABLE BELT DEVELOPMENT FOR SUBCOMPACT CAR PASSENGERS. FINAL REPORT | HS-801 719 |
| INFLATABLE BELT DEVELOPMENT FOR SUBCOMPACT CAR PASSENGERS. EXECUTIVE SUMMARY. FINAL REPORT | HS-801 720 |
| INFLATION DEVELOPMENT OF IMPROVED INFLATION TECHNIQUES. FINAL REPORT | HS-801 724 |
| THE TRANSPORTATION INDUSTRY CONFERENCE ON INFLATION, LOS ANGELES, CALIFORNIA, SEPTEMBER 19-20, 1974 | HS-017 505 |
| INJECTION IDENTIFICATION AND MODELING OF ROTARY FUEL INJECTION PUMP NOISE PROCESSES | HS-017 536 |
| INJECTION NOISE AND ITS RELATION TO FUEL PUMP AND ENGINE NOISE | HS-017 535 |
| NOISE, EMISSIONS AND PERFORMANCE OF THE DIESEL ENGINE. A COMPARISON BETWEEN DI [DIRECT INJECTION] AND IDI [INDIRECT INJECTION] COMBUSTION SYSTEMS | HS-017 529 |
| INJURIES BICYCLE INJURIES: ONE-YEAR SAMPLE IN CALGARY [CANADA] | HS-017 428 |
| INJURIES OCCURRING IN MOTORCYCLE ACCIDENTS | HS-017 568 |
| THE PROTECTIVE VALUE OF CONTEMPORARY MOTORCYCLE HELMETS IN THE PREVENTION OF HEAD INJURIES | HS-017 569 |
| INJURY DEATH AND INJURY ROAD ACCIDENTS IN NORTHERN IRELAND, 1974 | HS-017 436 |
| THORACIC IMPACT INJURY MECHANISM. VOL. 1. FINAL REPORT | HS-801 710 |
| THORACIC IMPACT INJURY MECHANISM. VOL. 2. [APPENDICES.] FINAL REPORT | HS-801 711 |
| INNERLINER IDENTIFICATION OF ELASTOMERS IN TIRE SECTIONS BY TOTAL THERMAL ANALYSIS. 4. INNERLINER | HS-017 551 |
| INSTRUCTOR COMMERCIAL DRIVING SCHOOL INSTRUCTOR: PROJECT AT OHLONE COLLEGE. FINAL REPORT | HS-801 746 |
| INTERACTION DRIVER ROAD SIGN INTERACTION | HS-017 563 |
| INTERACTIONS INTERACTIONS OF OCCUPANT AGE, VEHICLE WEIGHT, AND THE PROBABILITY OF DYING IN A TWO-VEHICLE CRASH | HS-017 472 |
| INTERINDIVIDUAL INTERINDIVIDUAL DIFFERENCES IN MESOPIC NIGHT VISION ABILITY MEASURED BY THE MESOPTOMETER | HS-017 481 |
| INTERMIXING EFFECTS OF INTERMIXING OF BIAS, BIAS BELTED, AND RADIAL PLY PASSENGER TIRES ON VEHICLE | |

**DYNAMICS AND DRIVER/VEHICLE RESPONSES.
FINAL REPORT**

HS-801 702

INTERSECTION

RELATIONSHIP OF ACCIDENT PATTERNS TO TYPE
OF INTERSECTION CONTROL

HS-017 514

INTERSECTIONS

EFFECTS OF INCREASED ENFORCEMENT AT
URBAN INTERSECTIONS ON DRIVER BEHAVIOR
AND SAFETY

HS-017 515

INTERSTATE

EFFECT OF 55-MPH SPEED LIMIT ON AVERAGE
SPEEDS OF FREE-FLOWING AUTOMOBILES ON AN
INTERSTATE BRIDGE IN WEST VIRGINIA

HS-017 575

INTOXICATION

DELAYED EFFECTS OF ACUTE ALCOHOLIC INTOXI-
CATION ON PERFORMANCE WITH REFERENCE TO
WORK SAFETY

HS-017 510

THE DEVELOPMENT OF TECHNOLOGY FOR DETEC-
TION OF MARIJUANA INTOXICATION BY ANALYSIS
OF BODY FLUIDS. FINAL REPORT

HS-801 721

INTRUSION

DEVELOPMENT OF LIGHTWEIGHT DOOR INTRU-
SION BEAMS UTILIZING AN ULTRA HIGH
STRENGTH STEEL

HS-017 486

INVOLVEMENT

COMMENTS ON ALCOHOL INVOLVEMENT IN
FATAL AND NON-FATAL CRASHES

HS-017 562

IRELAND

DEATH AND INJURY ROAD ACCIDENTS IN
NORTHERN IRELAND, 1974

HS-017 436

IRON

EFFECTS OF GRAPHITE MORPHOLOGY, MATRIX
HARDNESS, AND STRUCTURE ON THE FATIGUE
RESISTANCE OF GRAY CAST IRON

HS-017 441

JERSEY

HIGHWAY ACCIDENT REPORT. GEORGE WOLLMAN
MEATS, INC., TRUCK/AUTO/GREYHOUND BUS COL-
LISION AND FIRE, NEW JERSEY TURNPIKE, BOR-
DENTOWN, NEW JERSEY, OCTOBER 19, 1973

HS-017 491

LATERAL

DESIGN AND IMPLEMENTATION OF A SYSTEM TO
RECORD DRIVER LATERAL POSITIONING

HS-017 574

OCCUPANT SURVIVABILITY IN LATERAL COLLIS-
IONS. PROGRESS REPORTS 7-13, 1 FEBRUARY 1975
TO 31 AUGUST 1975

HS-801 751

LAWS

THE INTRODUCTION OF COMPULSORY SEAT BELT
WEARING LAWS IN AUSTRALIA AND THEIR E-
FFECT

HS-017 5

LICENCE

REFLECTORISED NUMBER (LICENCE) PLATES
[REFLECTORIZED LICENSE PLATES] AND TRAFFIC
SAFETY IN AUSTRALIA

HS-017 5

LICENCE

REFLECTORISED NUMBER (LICENCE) PLATES
[REFLECTORIZED LICENSE PLATES] AND TRAFFIC
SAFETY IN AUSTRALIA

HS-017 5

LICENSING

MOTORCYCLE TRAINING FOR CALIFORNIA DRIVER
LICENSING PERSONNEL. FINAL REPORT

HS-017 4

LIGHTING

EUROPEAN APPROACH TO THE LUMINANCE
ASPECT OF ROADWAY LIGHTING

HS-017 4

LIGHTWEIGHT

DEVELOPMENT OF LIGHTWEIGHT DOOR INTRU-
SION BEAMS UTILIZING AN ULTRA HIGH
STRENGTH STEEL

HS-017 4

LIMITED

ANALYSIS OF DRIVER CONTROL MOVEMENTS ON
A LIMITED-ACCESS DIVIDED HIGHWAY

HS-017 4

LIQUID

ADVANCES IN LOW TEMPERATURE LIQUID NITRO-
GEN

HS-017 4

LOADING

EFFECT OF PASSENGER LOADING ON DRIVER
VISIBILITY [FIELD OF VIEW] FROM AUTOMOBILE

HS-801 7

LOCATION

METHODOLOGIES FOR THE EVALUATION AND IMPROVEMENT OF EMERGENCY MEDICAL SERVICE SYSTEMS. VOL. 3. COMPUTERIZED AMBULANCE LOCATION LOGIC USERS MANUAL: PL/I AND FORTRAN VERSIONS. FINAL REPORT

HS-017 7

LOGIC

METHODOLOGIES FOR THE EVALUATION AND IMPROVEMENT OF EMERGENCY MEDICAL SERVICE SYSTEMS. VOL. 3. COMPUTERIZED AMBULANCE LOCATION LOGIC USERS MANUAL: PL/I AND FORTRAN VERSIONS. FINAL REPORT

HS-017 7

LOREAN

DE LOREAN REPORT TO FEDERAL ENERGY ADMINISTRATION SAYS FUEL SAVING CARS NEED

LUMINANCE

EUROPEAN APPROACH TO THE LUMINANCE ASPECT OF ROADWAY LIGHTING

HS-017 467

MAINTENANCE

AUTOMATIC VEHICLE CONTROLLER. OPERATOR'S AND MAINTENANCE MANUAL

HS-801 716

MANAGEMENT

POLICE MANAGEMENT TRAINING. FACTORS INFLUENCING DWI ARRESTS. FINAL TECHNICAL REPORT

HS-801 731

MANDATORY

CONSIDERATIONS IN THE USE OF SAMPLING PLANS FOR EFFECTING COMPLIANCE WITH MANDATORY SAFETY STANDARDS. FINAL REPORT

HS-017 426

MANEUVERS

THE PERCEPTION OF MANOEUVRES [MANEUVERS] OF MOVING VEHICLES. PROGRESS REPORT NO. 6. IMPLICATIONS OF PSYCHOPHYSICAL THRESHOLD MEASUREMENT FOR THE NIGHT DRIVING SITUATION. FINAL REPORT

HS-017 470

TIRE-PAVEMENT FRICTION AS A FUNCTION OF VEHICLE MANEUVERS. FINAL REPORT

HS-017 427

MANOEUVRES

THE PERCEPTION OF MANOEUVRES [MANEUVERS] OF MOVING VEHICLES. PROGRESS REPORT NO. 6. IMPLICATIONS OF PSYCHOPHYSICAL THRESHOLD MEASUREMENT FOR THE NIGHT DRIVING SITUATION. FINAL REPORT

HS-017 470

MANUFACTURING

SHEET METAL STRETCH FLANGE ANALYSIS: A MANUFACTURING VIEWPOINT

HS-017 440

MARIJUANA

THE DEVELOPMENT OF TECHNOLOGY FOR DETECTION OF MARIJUANA INTOXICATION BY ANALYSIS OF BODY FLUIDS. FINAL REPORT

HS-801 721

MASS

SAFETY IN MASS TRANSIT: A CASE STUDY OF BUS ACCIDENTS IN WASHINGTON, D.C.

HS-017 504

MATERIALS

CRASH CUSHIONS OF WASTE MATERIALS

HS-017 430

EVALUATING THE EFFECTS OF CORROSION ON STRUCTURAL MATERIALS. A STUDY OF PLAIN CARBON AND HIGH STRENGTH LOW ALLOY STEELS

HS-017 453

HIGH STRENGTH MATERIALS AND VEHICLE WEIGHT REDUCTION ANALYSIS

HS-017 485

MATRIX

EFFECTS OF GRAPHITE MORPHOLOGY, MATRIX HARDNESS, AND STRUCTURE ON THE FATIGUE RESISTANCE OF GRAY CAST IRON

HS-017 441

MEASUREMENT

QUALITY MEASUREMENT OF EMERGENCY MEDICAL CARE

HS-017 572

TEMPERATURE MEASUREMENT FOR ADVANCED GAS TURBINE CONTROLS

HS-017 445

TEMPERATURE MEASUREMENT FOR GAS TURBINE ENGINES

HS-017 446

THE PERCEPTION OF MANOEUVRES [MANEUVERS] OF MOVING VEHICLES. PROGRESS REPORT NO. 6. IMPLICATIONS OF PSYCHOPHYSICAL THRESHOLD MEASUREMENT FOR THE NIGHT DRIVING SITUATION. FINAL REPORT

HS-017 470

MEASUREMENTS

TEST VARIABILITY OF EMISSION AND FUEL ECONOMY MEASUREMENTS USING THE 1975 FEDERAL TEST PROCEDURE

HS-017 437

MEASURING

ANALYSIS OF METHODOLOGY FOR MEASURING NATIONAL HIGHWAY TRAFFIC SAFETY. FINAL REPORT

HS-801 741

COOPERATIVE EVALUATION OF TECHNIQUES FOR MEASURING NITRIC OXIDE AND CARBON MONOXIDE (PHASE 4 TESTS)

HS-017 443

CRC EVALUATION OF TECHNIQUES FOR MEASURING HYDROCARBONS IN DIESEL EXHAUST. PHASE 4

HS-017 442

METHODS OF MEASURING DRIVER BEHAVIOUR [BEHAVIOR]

HS-017 565

MEATS

HIGHWAY ACCIDENT REPORT. GEORGE WOLLMAN MEATS, INC., TRUCK/AUTO/GREYHOUND BUS COLLISION AND FIRE, NEW JERSEY TURNPIKE, BORDENTOWN, NEW JERSEY, OCTOBER 19, 1973

HS-017 491

MECHANISM

THORACIC IMPACT INJURY MECHANISM. VOL. 1. FINAL REPORT

HS-801 710

THORACIC IMPACT INJURY MECHANISM. VOL. 2. [APPENDICIES.] FINAL REPORT

HS-801 711

MEDICAL

AN EVALUATION METHODOLOGY FOR EMERGENCY MEDICAL SERVICES

HS-017 571

METHODOLOGIES FOR THE EVALUATION AND IMPROVEMENT OF EMERGENCY MEDICAL SERVICE SYSTEMS. VOL. 3. COMPUTERIZED AMBULANCE LOCATION LOGIC USERS MANUAL: PL/I AND FORTRAN VERSIONS. FINAL REPORT

HS-801 704

QUALITY MEASUREMENT OF EMERGENCY MEDICAL CARE

HS-017 572

MESOPIC

INTERINDIVIDUAL DIFFERENCES IN NIGHT VISION ABILITY MEASURED BY THE MESOPTOMETER

HS-017 481

MESOPTOMETER

INTERINDIVIDUAL DIFFERENCES IN NIGHT VISION ABILITY MEASURED BY THE MESOPTOMETER

HS-017 481

METAL

SHEET METAL STRETCH FLANGE ANALYSIS: A MANUFACTURING VIEWPOINT

HS-017 440

METHODOLOGIES

METHODOLOGIES FOR THE EVALUATION AND IMPROVEMENT OF EMERGENCY MEDICAL SERVICE SYSTEMS. VOL. 2. APPENDICES. FINAL REPORT

HS-801 704

METHODOLOGIES FOR THE EVALUATION AND IMPROVEMENT OF EMERGENCY MEDICAL SERVICE SYSTEMS. VOL. 3. COMPUTERIZED AMBULANCE LOCATION LOGIC USERS MANUAL: PL/I AND FORTRAN VERSIONS. FINAL REPORT

HS-801 705

METHODOLOGY

AN EVALUATION METHODOLOGY FOR EMERGENCY MEDICAL SERVICES

HS-017 571

ANALYSIS OF METHODOLOGY FOR MEASURING NATIONAL HIGHWAY TRAFFIC SAFETY. FINAL REPORT

HS-801 741

METRICATION

HIGHWAY METRICATION. VOL. 1. TASKS 1, 2, 3, 4, AND APERCU. FINAL REPORT

HS-017 483

HIGHWAY METRICATION. VOL. 2. APPENDICES. FINAL REPORT

HS-017 484

MICHIGAN

EFFECTS OF THE ENERGY CRISIS AND 55 MPH SPEED LIMIT IN MICHIGAN. FINAL REPORT

HS-017 463

MILITARY

THE EFFECT OF AUTOMATIC TRANSMISSIONS ON MILITARY TRUCK FUEL ECONOMY

HS-017 450

MINIMUM

A UNIQUE CONCEPT FOR AUTOMATICALLY CONTROLLING THE BRAKING ACTION OF WHEELS ON VEHICLES DURING MINIMUM DISTANCE STOPS

HS-017 500

MINORITY

CHILDREN AS PASSENGERS IN AUTOMOBILES: THE NEGLECTED MINORITY ON THE NATIONAL HIGHWAYS

HS-017 470

MODEL

MODEL POLICE TRAFFIC SERVICES, POLICING PROCEDURES, RULES, AND REGULATION MANUAL. PHASE 2. MODEL POLICE TRAFFIC SERVICES PROCEDURES

HS-801 700

OCCUPANT MODEL FOR HUMAN MOTION

HS-017 470

SIMPLE MODEL TECHNIQUE FOR BETTER UNDERSTANDING OF DIESEL ENGINE VIBRATION AND NOISE

HS-017 500

THREE-DIMENSIONAL HUMAN DISPLAY MODEL

HS-017 500

MODELING

IDENTIFICATION AND MODELING OF ROTARY FUEL INJECTION PUMP NOISE PROCESSES

HS-017 500

MODELS

THE DEVELOPMENT AND COMPARATIVE EVALUATION OF ANALYTICAL TIRE MODELS FOR DYNAMIC VEHICLE SIMULATION. FINAL REPORT

HS-017 500

MODULE

USER MANUAL FOR THE TRAFFIC ACCIDENT RECORDING MODULE

HS-017 470

MONOXIDE

COOPERATIVE EVALUATION OF TECHNIQUES FOR MEASURING NITRIC OXIDE AND CARBON MONOXIDE (PHASE 4 TESTS)

HS-017 470

MOPED

CRASH HELMETS FOR MOPED RIDERS

HS-017 470

MORPHOLOGY

EFFECTS OF GRAPHITE MORPHOLOGY, MATRICES, HARDNESS, AND STRUCTURE ON THE FATIGUE RESISTANCE OF GRAY CAST IRON

HS-017 470

MOTION

MOTION RESISTANCE OF PNEUMATIC TYRES [TIRES]

HS-017 500

OCCUPANT MODEL FOR HUMAN MOTION

HS-017 470

March 31, 1976

MOTOR

A SURVEY OF MOTOR VEHICLE BURN ACCIDENTS
IN CHILDREN: REPORT OF 45 CASES

HS-017 499

FACTORS CONTRIBUTING TO THE REDUCTION OF
MOTOR VEHICLE FATALITIES IN 1974

HS-017 509

MOTOR CARRIER ACCIDENT INVESTIGATION.
WARE OIL AND SUPPLY CO., INC. ACCIDENT--
MARCH 1, 1975--PERRY, FLORIDA

HS-017 478

MOTOR VEHICLE SAFETY DEFECT RECALL CAM-
PAIGNS--DETAILED REPORTS FROM APRIL 1 TO
JUNE 30, 1975

HS-801 662

RESTRAINT USE AND EFFECTIVENESS IN REAL-
WORLD CRASHES; FEW CHILDREN PROTECTED IN
CARS; [AND] PAPERS RELEVANT TO FEDERAL
MOTOR VEHICLE SAFETY

HS-017 507

TRAFFIC SAFETY '74. A REPORT ON ACTIVITIES
UNDER THE NATIONAL TRAFFIC AND MOTOR
VEHICLE SAFETY ACT OF 1966 AND THE MOTOR
VEHICLE INFORMATION AND COST SAVINGS ACT
OF 1972.

HS-801 700

1975 MOTOR TRUCK FACTS

HS-017 557

MOTORCYCLE

INJURIES OCCURRING IN MOTORCYCLE AC-
CIDENTS

HS-017 568

MOTORCYCLE TRAINING FOR CALIFORNIA DRIVER
LICENSING PERSONNEL. FINAL REPORT

HS-017 459

MOTORCYCLE TRAINING--STANDARDS FOR SUR-
VIVAL

HS-017 570

THE PROTECTIVE VALUE OF CONTEMPORARY MO-
TORCYCLE HELMETS IN THE PREVENTION OF
HEAD INJURIES

HS-017 569

MOVEMENT

TRANSVERSE MOVEMENT ANALYSIS AND ITS IN-
FLUENCE ON DIESEL PISTON DESIGN

HS-017 533

MOVEMENTS

ANALYSIS OF DRIVER CONTROL MOVEMENTS ON
A LIMITED-ACCESS DIVIDED HIGHWAY

HS-017 489

MOVING

THE PERCEPTION OF MANOEUVRES [MANEUVERS]
OF MOVING VEHICLES. PROGRESS REPORT NO. 6.
IMPLICATIONS OF PSYCHOPHYSICAL THRESHOLD
MEASUREMENT FOR THE NIGHT DRIVING SITUA-
TION. FINAL REPORT

HS-017 470

MULTIDISCIPLINARY

MULTIDISCIPLINARY ACCIDENT INVESTIGATION
DATA FILE. 1974 FINAL REPORT

NATIONAL

ANALYSIS OF METHODOLOGY FOR MEASURING
NATIONAL HIGHWAY TRAFFIC SAFETY. FINAL RE-
PORT

HS-801 741

STATEMENT BEFORE THE NATIONAL HIGHWAY
TRAFFIC SAFETY ADMINISTRATION (NHTSA) AT
THE PUBLIC MEETING ON STANDARD NO. 208, OC-
CUPANT CRASH PROTECTION, HELD MAY 19, 1975

HS-017 506

STATEWIDE HIGHWAY SAFETY PROGRAM ASSES-
MENT. A NATIONAL ESTIMATE OF PERFORMANCE.
JULY, 1975

HS-801 742

TRAFFIC SAFETY '74. A REPORT ON ACTIVITIES
UNDER THE NATIONAL TRAFFIC AND MOTOR
VEHICLE SAFETY ACT OF 1966 AND THE MOTOR
VEHICLE INFORMATION AND COST SAVINGS ACT
OF 1972.

HS-801 700

NEGLECTED

CHILDREN AS PASSENGERS IN AUTOMOBILES: THE
NEGLECTED MINORITY ON THE NATION'S
HIGHWAYS

HS-017 493

NEOPRENE

IDENTIFICATION OF ELASTOMERS IN TIRE SEC-
TIONS BY TOTAL THERMAL ANALYSIS. 3. WHITE
SIDEWALL COMPOUNDS OF NEOPRENE RUBBER
BLENDS

HS-017 550

NEWS

DE LOREAN REPORT TO FEDERAL ENERGY AD-
MINISTRATION SAYS FUEL SAVING CARS NEED
AIR BAGS [NEWS RELEASE]

HS-017 474

NHTSA

STATEMENT BEFORE THE NATIONAL HIGHWAY
TRAFFIC SAFETY ADMINISTRATION (NHTSA) AT
THE PUBLIC MEETING ON STANDARD NO. 208, OC-
CUPANT CRASH PROTECTION, HELD MAY 19, 1975

HS-017 506

NIGHT

EYE FIXATIONS OF DRIVERS IN NIGHT DRIVING
WITH THREE HEADLIGHT [HEADLAMP] BEAMS.
FINAL REPORT

HS-017 547

INTERINDIVIDUAL DIFFERENCES IN MESOPIC
NIGHT VISION ABILITY MEASURED BY THE
MESOPTOMETER

HS-017 481

THE PERCEPTION OF MANOEUVRES [MANEUVERS]
OF MOVING VEHICLES. PROGRESS REPORT NO. 6.
IMPLICATIONS OF PSYCHOPHYSICAL THRESHOLD
MEASUREMENT FOR THE NIGHT DRIVING SITUA-
TION. FINAL REPORT

HS-017 470

NISSAN

ACCIDENT AVOIDANCE TEST REPORT--NISSAN AND
TOYOTA EXPERIMENTAL SAFETY VEHICLES.

NITRIC

COOPERATIVE EVALUATION OF TECHNIQUES FOR MEASURING NITRIC OXIDE AND CARBON MONOXIDE (PHASE 4 TESTS)

HS-017 443

NITRIDING

ADVANCES IN LOW TEMPERATURE LIQUID NITRIDING

HS-017 438

NOISE

AFFECTING DIESEL ENGINE NOISE BY THE PISTON

HS-017 532

DESIGN CONCEPTS OF DIESEL ENGINES WITH LOW NOISE EMISSION

HS-017 543

DIESEL ENGINE NOISE CONFERENCE

HS-017 527

EFFECT OF TURBOCHARGING ON DIESEL ENGINE NOISE, EMISSIONS AND PERFORMANCE

HS-017 530

IDENTIFICATION AND MODELING OF ROTARY FUEL INJECTION PUMP NOISE PROCESSES

HS-017 536

INJECTION NOISE AND ITS RELATION TO FUEL PUMP AND ENGINE NOISE

HS-017 535

LOW NOISE OPPOSED PISTON TWO-STROKE ENGINE AND BLOWER

HS-017 545

MODES OF ENGINE STRUCTURE VIBRATION AS A SOURCE OF NOISE

HS-017 538

NOISE--THE DIESEL ENGINE DESIGNERS' DILEMMA

HS-017 546

NOISE, EMISSIONS AND PERFORMANCE OF THE DIESEL ENGINE. A COMPARISON BETWEEN DI [DIRECT INJECTION] AND IDI [INDIRECT INJECTION] COMBUSTION SYSTEMS

HS-017 529

PASSENGER NOISE ENVIRONMENTS OF ENCLOSED TRANSPORTATION SYSTEMS

HS-017 521

PISTON SLAP NOISE OF INDIRECT COMBUSTION DIESEL ENGINE

HS-017 534

PRACTICAL MEANS FOR REDUCING THE NOISE OF FAST DIESEL ENGINES

HS-017 542

SIMPLE MODEL TECHNIQUE FOR BETTER UNDERSTANDING OF DIESEL ENGINE VIBRATION AND NOISE

HS-017 539

TECHNIQUES OF STRUCTURAL VIBRATION ANALYSIS APPLIED TO DIESEL ENGINE NOISE REDUCTION

HS-017 540

THE PROBLEMS OF NOISE OF ENGINES IN DIFFERENT VEHICLE GROUPS

HS-017 528

NOISES

THE EFFECT OF COMBUSTION SYSTEM ON ENGINE NOISES

HS-017 531

NORTHERN

DEATH AND INJURY ROAD ACCIDENTS IN NORTHERN IRELAND, 1974

HS-017 436

NUMBER

REFLECTORISED NUMBER (LICENCE) PLATES [REFLECTORIZED LICENSE PLATES] AND TRAFFIC SAFETY IN AUSTRALIA

HS-017 518

OBLIGATIONS

ENGINEERING KNOW-HOW IN ENGINE DESIGN. PART 23. ENGINE DESIGN TO MEET NEW SOCIAL OBLIGATIONS

HS-017 522

OCCUPANT

AUTOMOTIVE OCCUPANT PROTECTIVE SAFETY AIR CUSHION %AIR BAG% EXPENDITURE/BENEFIT STUDY [APPENDIX I. COMPUTER RUN SUMMARY]

HS-017 475

AUTOMOTIVE OCCUPANT PROTECTIVE SAFETY AIR CUSHION [AIR BAG] EXPENDITURE/BENEFIT STUDY

HS-017 476

INTERACTIONS OF OCCUPANT AGE, VEHICLE WEIGHT, AND THE PROBABILITY OF DYING IN A TWO-VEHICLE CRASH

HS-017 472

OCCUPANT MODEL FOR HUMAN MOTION

HS-017 434

OCCUPANT SURVIVABILITY IN LATERAL COLLISIONS. PROGRESS REPORTS 7-13, 1 FEBRUARY 1975 TO 31 AUGUST 1975

HS-801 751

STATEMENT BEFORE THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA) AT THE PUBLIC MEETING ON STANDARD NO. 208, OCCUPANT CRASH PROTECTION, HELD MAY 19, 1975

HS-017 506

OCCUPANTS

SERIOUS TRAUMA TO CAR OCCUPANTS WEARING SEAT BELTS

HS-017 494

OCCURRING

INJURIES OCCURRING IN MOTORCYCLE ACCIDENTS

HS-017 568

OHLONE

COMMERCIAL DRIVING SCHOOL INSTRUCTOR: PROJECT AT OHLONE COLLEGE. FINAL REPORT

March 31, 1976

OIL

MOTOR CARRIER ACCIDENT INVESTIGATION.
WARE OIL AND SUPPLY CO., INC. ACCIDENT--
MARCH 1, 1975--PERRY, FLORIDA

HS-017 478

ONTARIO

TRAFFIC SAFETY. PROCEEDINGS OF THE SCIENTIFIC CONFERENCE, OTTAWA, ONTARIO, CANADA,
MAY 23 AND 24, 1974

HS-017 559

OPERATION

CAPACITY ANALYSIS TECHNIQUES FOR DESIGN
AND OPERATION OF FREEWAY FACILITIES. FINAL
REPORT

HS-017 520

OPERATOR

AUTOMATIC VEHICLE CONTROLLER. OPERATOR'S
AND MAINTENANCE MANUAL

HS-801 716

OPPOSED

LOW NOISE OPPOSED PISTON TWO-STROKE ENGINE
AND BLOWER

HS-017 545

ORLANDO

TRANSPORTATION PROGRAMMING PROCESS.
PROCEEDINGS OF A CONFERENCE, ORLANDO,
FLORIDA, 23-26 MARCH 1975.

HS-017 482

OTTAWA

TRAFFIC SAFETY. PROCEEDINGS OF THE SCIENTIFIC CONFERENCE, OTTAWA, ONTARIO, CANADA,
MAY 23 AND 24, 1974

HS-017 559

OXIDE

COOPERATIVE EVALUATION OF TECHNIQUES FOR
MEASURING NITRIC OXIDE AND CARBON MONOXIDE
(PHASE 4 TESTS)

HS-017 443

PANEL

PROBLEMS, PROGRESS AND GOALS IN TRAFFIC
SAFETY [PANEL DISCUSSION]

HS-017 573

PARKED

EVALUATION OF WHEEL BLOCKING FOR VEHICLES
PARKED ON SLOPES

HS-017 511

PART

ENGINEERING KNOW-HOW IN ENGINE DESIGN.
PART 23. ENGINE DESIGN TO MEET NEW SOCIAL
OBLIGATIONS

HS-017 522

MEASURED ILLUMINATION CHARACTERISTICS OF
THE 1974 HEADLAMPS. PART 1. THE S.A.E.
HEADLAMPS

HS-017 555

PASSENGER

EFFECT OF PASSENGER LOADING ON DRIVER'S

EFFECTS OF INTERMIXING OF BIAS, BIAS BELTED,
AND RADIAL PLY PASSENGER TIRES ON VEHICLE
DYNAMICS AND DRIVER/VEHICLE RESPONSES.
FINAL REPORT

HS-801 702

HUMAN FACTOR AND HARDWARE DESIGN CONSIDERATIONS FOR PASSENGER PROTECTION IN
HIGH SPEED CRASHES

HS-017 554

PASSENGER NOISE ENVIRONMENTS OF ENCLOSED
TRANSPORTATION SYSTEMS

HS-017 521

PASSENGERS

ADVANCED PASSIVE RESTRAINT SYSTEM FOR SUBCOMPACT SIZE VEHICLE FRONT SEAT PASSENGERS. PROGRESS REPORTS 14 AND 15, 4 AUGUST
1975 TO 5 OCTOBER 1975

HS-801 752

CHILDREN AS PASSENGERS IN AUTOMOBILES: THE
NEGLECTED MINORITY ON THE NATION'S
HIGHWAYS

HS-017 493

INFLATABLE BELT DEVELOPMENT FOR SUBCOMPACT CAR PASSENGERS. FINAL REPORT

HS-801 719

INFLATABLE BELT DEVELOPMENT FOR SUBCOMPACT CAR PASSENGERS. EXECUTIVE SUMMARY.
FINAL REPORT

HS-801 720

PASSIVE

ADVANCED PASSIVE RESTRAINT SYSTEM FOR SUBCOMPACT SIZE VEHICLE FRONT SEAT PASSENGERS. PROGRESS REPORTS 14 AND 15, 4 AUGUST
1975 TO 5 OCTOBER 1975

HS-801 752

PATTERNS

REAR-IMPACTED VEHICLE COLLISIONS: FREQUENCIES AND CASUALTY PATTERNS. FINAL REPORT

HS-017 461

RELATIONSHIP OF ACCIDENT PATTERNS TO TYPE
OF INTERSECTION CONTROL

HS-017 514

PAVEMENT

TIRE-PAVEMENT FRICTION AS A FUNCTION OF
VEHICLE MANEUVERS. FINAL REPORT

HS-017 427

PEDESTRIAN

ASSESSMENT OF PEDESTRIAN ATTITUDES AND
BEHAVIOR IN SUBURBAN ENVIRONMENTS

HS-017 517

COMPENDIUM OF PEDESTRIAN-BICYCLE SAFETY
PROGRAMS

HS-017 471

DRIVER PERCEPTION OF PEDESTRIAN CONSPICUOUSNESS UNDER STANDARD HEADLIGHT
[HEADLAMP] ILLUMINATION

HS-017 516

SPECIALIZED ILLUMINATION SYSTEMS FOR
PEDESTRIAN CROSSWALKS

HS-017 466

PEDESTRIANS

THE PERCEPTION OF VEHICLE SPEEDS BY
PEDESTRIANS HS-017 432

PERCEPTION

DRIVER PERCEPTION OF PEDESTRIAN CON-
SPICUOUSNESS UNDER STANDARD HEADLIGHT
[HEADLAMP] ILLUMINATION

HS-017 516

THE PERCEPTION OF MANOEUVRES [MANEUVERS]
OF MOVING VEHICLES. PROGRESS REPORT NO. 6.
IMPLICATIONS OF PSYCHOPHYSICAL THRESHOLD
MEASUREMENT FOR THE NIGHT DRIVING SITUA-
TION. FINAL REPORT

HS-017 470

THE PERCEPTION OF VEHICLE SPEEDS BY
PEDESTRIANS

HS-017 432

PERFORMANCE

DELAYED EFFECTS OF ACUTE ALCOHOLIC INTOXI-
CATION ON PERFORMANCE WITH REFERENCE TO
WORK SAFETY

HS-017 510

DRIVER PERFORMANCE RELATED TO THE VEHI-
CLE

HS-017 564

EFFECT OF TURBOCHARGING ON DIESEL ENGINE
NOISE, EMISSIONS AND PERFORMANCE

HS-017 530

NOISE, EMISSIONS AND PERFORMANCE OF THE
DIESEL ENGINE. A COMPARISON BETWEEN DI
[DIRECT INJECTION] AND IDI [INDIRECT INJEC-
TION] COMBUSTION SYSTEMS

HS-017 529

PERFORMANCE AND APPLICATION OF THE EX-
DUCER POWER TURBINE

HS-017 447

STATEWIDE HIGHWAY SAFETY PROGRAM ASSESS-
MENT. A NATIONAL ESTIMATE OF PERFORMANCE.
JULY, 1975

HS-801 742

PERRY

MOTOR CARRIER ACCIDENT INVESTIGATION.
WARE OIL AND SUPPLY CO., INC. ACCIDENT--
MARCH 1, 1975--PERRY, FLORIDA

HS-017 478

PERSONALITY

STYLE, PERSONALITY AND ACCIDENTS

HS-017 500

PERSONNEL

MOTORCYCLE TRAINING FOR CALIFORNIA DRIVER
LICENSING PERSONNEL. FINAL REPORT

HS-017 459

PISTON

AFFECTING DIESEL ENGINE NOISE BY THE PISTON
HS-017 532

LOW NOISE OPPOSED PISTON TWO-STROKE EN-
GINE AND BLOWER

HS-017 545

PISTON SLAP NOISE OF INDIRECT COMBUSTION
DIESEL ENGINE

HS-017 532

TRANSVERSE MOVEMENT ANALYSIS AND ITS I-
FLUENCE ON DIESEL PISTON DESIGN

HS-017 532

PL/I

METHODOLOGIES FOR THE EVALUATION AND I-
PROVEMENT OF EMERGENCY MEDICAL SERVICE
SYSTEMS. VOL. 3. COMPUTERIZED AMBULANCE
LOCATION LOGIC USERS MANUAL: PL/I AND FOR-
TRAN VERSIONS. FINAL REPORT

HS-801 178

PLANS

CONSIDERATIONS IN THE USE OF SAMPLING
PLANS FOR EFFECTING COMPLIANCE WITH MA-
DATORY SAFETY STANDARDS. FINAL REPORT

HS-017 532

PLATES

REFLECTORISED NUMBER (LICENCE) PLATES
[REFLECTORIZED LICENSE PLATES] AND TRAFFIC
SAFETY IN AUSTRALIA

HS-017 532

PLY

EFFECTS OF INTERMIXING OF BIAS, BIAS BELT-
AND RADIAL PLY PASSENGER TIRES ON VEHICLE
DYNAMICS AND DRIVER/VEHICLE RESPONSE
FINAL REPORT

HS-801 178

PNEUMATIC

MOTION RESISTANCE OF PNEUMATIC TYRES
[TIRES]

HS-017 532

ROLLING RESISTANCE OF PNEUMATIC TIRES. I-
TERIM REPORT

HS-017 532

POLICE

MODEL POLICE TRAFFIC SERVICES, POLICING
PROCEDURES, RULES, AND REGULATION
MANUAL. PHASE 2. MODEL POLICE TRAFFIC SER-
VICES PROCEDURES

HS-801 178

POLICE MANAGEMENT TRAINING. FACTORS I-
FLUENCING DWI ARRESTS. FINAL TECHNICAL R-
PORT

HS-801 178

POSITIONING

DESIGN AND IMPLEMENTATION OF A SYSTEM
RECORD DRIVER LATERAL POSITIONING

HS-017 532

POWER

ENERGY ECONOMICS OF AUTOMOTIVE POW-
ER GENERATION

HS-017 532

PERFORMANCE AND APPLICATION OF THE EX-
DUCER POWER TURBINE

HS-017 532

March 31, 1976

PRACTICES

RIGHT-TURN-ON-RED: CURRENT PRACTICES AND
STATE-OF-THE-ART. INTERIM REPORT

HS-017 503

PRECHAMBER

PRECHAMBER AND VALVE GEAR DESIGN FOR 3-
VALVE STRATIFIED CHARGE ENGINES

HS-017 526

PREDICTION

ANALYSIS AND PREDICTION OF ENGINE STRUC-
TURE VIBRATION

HS-017 537

PREVENTION

COUNTERMEASURES--A COMMUNITY BASED CAM-
PAIGN FOR THE PREVENTION OF DRUNK DRIVING:
AN EXPERIMENTAL EVALUATION

HS-017 560

THE PROTECTIVE VALUE OF CONTEMPORARY MO-
TORCYCLE HELMETS IN THE PREVENTION OF
HEAD INJURIES

HS-017 569

PRIVATE

THE LIGHT DUTY DIESEL ENGINE FOR PRIVATE
TRANSPORTATION

HS-017 488

PROBABILITY

INTERACTIONS OF OCCUPANT AGE, VEHICLE
WEIGHT, AND THE PROBABILITY OF DYING IN A
TWO-VEHICLE CRASH

HS-017 472

PROCEDURE

TEST VARIABILITY OF EMISSION AND FUEL
ECONOMY MEASUREMENTS USING THE 1975
FEDERAL TEST PROCEDURE

HS-017 437

PROCEDURES

MODEL POLICE TRAFFIC SERVICES, POLICIES,
PROCEDURES, RULES, AND REGULATIONS.
MANUAL. PHASE 2. MODEL POLICE TRAFFIC SER-
VICES PROCEDURES

HS-801 734

PROGRAMMING

TRANSPORTATION PROGRAMMING PROCESS.
PROCEEDINGS OF A CONFERENCE, ORLANDO,
FLORIDA, 23-26 MARCH 1975.

HS-017 482

PROTECTION

HUMAN FACTOR AND HARDWARE DESIGN CON-
SIDERATIONS FOR PASSENGER PROTECTION IN
HIGH SPEED CRASHES

HS-017 554

STATEMENT BEFORE THE NATIONAL HIGHWAY
TRAFFIC SAFETY ADMINISTRATION (NHTSA) AT
THE PUBLIC MEETING ON STANDARD NO. 208, OC-
CUPANT CRASH PROTECTION, HELD MAY 19, 1975

HS-017 506

PROTECTIVE

AUTOMOTIVE OCCUPANT PROTECTIVE SAFETY AIR
CUSHION %AIR BAG% EXPENDITURE/BENEFIT
STUDY [APPENDIX I. COMPUTER RUN SUMMARY]

HS-017 475

AUTOMOTIVE OCCUPANT PROTECTIVE SAFETY AIR
CUSHION [AIR BAG] EXPENDITURE/BENEFIT
STUDY

HS-017 476

THE PROTECTIVE VALUE OF CONTEMPORARY MO-
TORCYCLE HELMETS IN THE PREVENTION OF
HEAD INJURIES

HS-017 569

PROTOTYPE

TESTING OF FOREIGN PROTOTYPE EXPERIMENTAL
SAFETY VEHICLES--PROGRAM SUMMARY REPORT.
FINAL REPORT

HS-801 717

PSYCHOPHYSICAL

THE PERCEPTION OF MANOEUVRES [MANEUVERS]
OF MOVING VEHICLES. PROGRESS REPORT NO. 6.
IMPLICATIONS OF PSYCHOPHYSICAL THRESHOLD
MEASUREMENT FOR THE NIGHT DRIVING SITUA-
TION. FINAL REPORT

HS-017 470

PUBLIC

STATEMENT BEFORE THE NATIONAL HIGHWAY
TRAFFIC SAFETY ADMINISTRATION (NHTSA) AT
THE PUBLIC MEETING ON STANDARD NO. 208, OC-
CUPANT CRASH PROTECTION, HELD MAY 19, 1975

HS-017 506

PUMP

IDENTIFICATION AND MODELING OF ROTARY
FUEL INJECTION PUMP NOISE PROCESSES

HS-017 536

INJECTION NOISE AND ITS RELATION TO FUEL
PUMP AND ENGINE NOISE

HS-017 535

QUALITY

QUALITY MEASUREMENT OF EMERGENCY MEDI-
CAL CARE

HS-017 572

UNIFORM TIRE QUALITY GRADING--TREADWEAR.
CITY TEST. FINAL REPORT

HS-801 735

QUIETING

TECHNIQUES FOR QUIETING THE DIESEL

HS-017 544

RADIAL

EFFECTS OF INTERMIXING OF BIAS, BIAS BELTED,
AND RADIAL PLY PASSENGER TIRES ON VEHICLE
DYNAMICS AND DRIVER/VEHICLE RESPONSES.
FINAL REPORT

HS-801 702

REAR

REAR-IMPACTED VEHICLE COLLISIONS: FREQUEN-
CIES AND CASUALTY PATTERNS. FINAL REPORT

HS-017 461

RECALL

DRIVER RECALL OF ROADSIDE SIGNS

HS-017 456

MOTOR VEHICLE SAFETY DEFECT RECALL CAMPAIGNS--DETAILED REPORTS FROM APRIL 1 TO JUNE 30, 1975

HS-801 662

RECORDING

USER MANUAL FOR THE TRAFFIC ACCIDENT RECORDING MODULE

HS-017 435

RED

RIGHT-TURN-ON-RED: CURRENT PRACTICES AND STATE-OF-THE-ART. INTERIM REPORT

HS-017 503

REEDUCATION

EVALUATING THE EFFECTIVENESS OF REEDUCATION PROGRAMS FOR CONVICTED [ALCOHOL] IMPAIRED DRIVERS

HS-017 458

REFLECTORISED

REFLECTORISED NUMBER (LICENCE) PLATES [REFLECTORIZED LICENSE PLATES] AND TRAFFIC SAFETY IN AUSTRALIA

HS-017 518

REFLECTORIZED

REFLECTORIZED NUMBER (LICENCE) PLATES [REFLECTORIZED LICENSE PLATES] AND TRAFFIC SAFETY IN AUSTRALIA

HS-017 518

REGULATION

THE EFFECTS OF AUTOMOBILE SAFETY REGULATION

HS-017 477

REGULATIONS

MODEL POLICE TRAFFIC SERVICES, POLICIES, PROCEDURES, RULES, AND REGULATIONS. MANUAL. PHASE 2. MODEL POLICE TRAFFIC SERVICES PROCEDURES

HS-801 734

RELATIONSHIP

RELATIONSHIP OF ACCIDENT PATTERNS TO TYPE OF INTERSECTION CONTROL

HS-017 514

RELATIONSHIPS

RELATIONSHIPS BETWEEN ROADWAY GEOMETRICS AND ACCIDENTS

HS-017 578

RELEASE

DE LOREAN REPORT TO FEDERAL ENERGY ADMINISTRATION SAYS FUEL SAVING CARS NEED AIR BAGS [NEWS RELEASE]

HS-017 474

RESISTANCE

EFFECTS OF GRAPHITE MORPHOLOGY, MATRIX HARDNESS, AND STRUCTURE ON THE FATIGUE

MOTION RESISTANCE OF PNEUMATIC TYRES [TIRES]

HS-017 581

ROLLING RESISTANCE OF PNEUMATIC TIRES. INTERIM REPORT

HS-017 519

RESPONSE

DRIVER RESPONSE TO THE 55 MPH MAXIMUM SPEED LIMIT AND THE VARIATIONAL CHARACTERISTICS OF SPOT SPEEDS

HS-017 464

STATEMENT OF THE STATE OF ILLINOIS IN RESPONSE TO THE HIGHWAY SAFETY SANCTION HEARING, WASHINGTON, D.C., SEPTEMBER 30, 1975

HS-017 502

THE APPLICATION OF IDEALIZATION AND RESPONSE ANALYSIS TO DIESEL ENGINE NOISE ASSESSMENT

HS-017 541

RESPONSES

EFFECTS OF INTERMIXING OF BIAS, BIAS BELTED, AND RADIAL PLY PASSENGER TIRES ON VEHICLE DYNAMICS AND DRIVER/VEHICLE RESPONSES. FINAL REPORT

HS-801 702

RESTRAINT

ADVANCED PASSIVE RESTRAINT SYSTEM FOR SUBCOMPACT SIZE VEHICLE FRONT SEAT PASSENGERS. PROGRESS REPORTS 14 AND 15, 4 AUGUST 1975 TO 5 OCTOBER 1975

HS-801 752

RESTRAINT USE AND EFFECTIVENESS IN REAL-WORLD CRASHES; FEW CHILDREN PROTECTED IN CARS; [AND] PAPERS RELEVANT TO FEDERAL MOTOR VEHICLE SAFETY

HS-017 507

RETROFITS

DIESEL EMISSION CONTROL THROUGH RETROFITS

HS-017 444

RIDERS

CRASH HELMETS FOR MOPED RIDERS

HS-017 431

RIGHT

RIGHT-TURN-ON-RED: CURRENT PRACTICES AND STATE-OF-THE-ART. INTERIM REPORT

HS-017 503

ROADSIDE

DRIVER RECALL OF ROADSIDE SIGNS

HS-017 456

ROADWAY

EUROPEAN APPROACH TO THE LUMINANCE ASPECT OF ROADWAY LIGHTING

HS-017 467

RELATIONSHIPS BETWEEN ROADWAY GEOMETRICS AND ACCIDENTS

HS-017 578

ROADWAY SIGN ILLUMINATION

March 31, 1976

ROLLING

EARLY DETECTION OF DEFECTS IN ROLLING-ELEMENT BEARINGS

HS-017 448

ROLLING RESISTANCE OF PNEUMATIC TIRES. INTERIM REPORT

HS-017 519

ROTARY

IDENTIFICATION AND MODELING OF ROTARY FUEL INJECTION PUMP NOISE PROCESSES

HS-017 536

RSV

RESEARCH SAFETY VEHICLE (RSV). PHASE 2. STATUS REPORT NO. 1

HS-801 730

RUBBER

IDENTIFICATION OF ELASTOMERS IN TIRE SECTIONS BY TOTAL THERMAL ANALYSIS. 3. WHITE SIDEWALL COMPOUNDS OF NEOPRENE RUBBER BLENDS

HS-017 550

RUBBING

A NOTE ON HEAT GENERATION DUE TO SURFACE RUBBING

HS-017 497

RULES

MODEL POLICE TRAFFIC SERVICES, POLICIES, PROCEDURES, RULES, AND REGULATIONS. MANUAL. PHASE 2. MODEL POLICE TRAFFIC SERVICES PROCEDURES

HS-801 734

RURAL

SPEED CONTROL IN RURAL SCHOOL ZONES

HS-017 577

SAMPLE

BICYCLE INJURIES: ONE-YEAR SAMPLE IN CALGARY [CANADA]

HS-017 428

SAMPLING

CONSIDERATIONS IN THE USE OF SAMPLING PLANS FOR EFFECTING COMPLIANCE WITH MANDATORY SAFETY STANDARDS. FINAL REPORT

HS-017 426

SANCTION

STATEMENT OF THE STATE OF ILLINOIS IN RESPONSE TO THE HIGHWAY SAFETY SANCTION HEARING, WASHINGTON, D.C., SEPTEMBER 30, 1975

HS-017 502

SAND

FULL SCALE CRASH TESTS OF A TIRE-SAND INERTIA BARRIER. INTERIM REPORT

HS-017 462

SAVING

DE LOREAN REPORT TO FEDERAL ENERGY ADMINISTRATION SAYS FUEL SAVING CARS NEED AIR BAGS [NEWS RELEASE]

HS-017 474

SAVINGS

TRAFFIC SAFETY '74. A REPORT ON ACTIVITIES UNDER THE NATIONAL TRAFFIC AND MOTOR VEHICLE SAFETY ACT OF 1966 AND THE MOTOR VEHICLE INFORMATION AND COST SAVINGS ACT OF 1972.

HS-801 700

SCALE

FULL SCALE CRASH TESTS OF A TIRE-SAND INERTIA BARRIER. INTERIM REPORT

HS-017 462

SCHOOL

COMMERCIAL DRIVING SCHOOL INSTRUCTOR: PROJECT AT OHLONE COLLEGE. FINAL REPORT

HS-801 746

SPEED CONTROL IN RURAL SCHOOL ZONES

HS-017 577

SURVEY OF SAFETY RELATED CONDITIONS IN SCHOOL BUSES. FINAL REPORT

HS-801 659

SCIENTIFIC

TRAFFIC SAFETY. PROCEEDINGS OF THE SCIENTIFIC CONFERENCE, OTTAWA, ONTARIO, CANADA, MAY 23 AND 24, 1974

HS-017 559

SEAT

ADVANCED PASSIVE RESTRAINT SYSTEM FOR SUBCOMPACT SIZE VEHICLE FRONT SEAT PASSENGERS. PROGRESS REPORTS 14 AND 15, 4 AUGUST 1975 TO 5 OCTOBER 1975

HS-801 752

SERIOUS TRAUMA TO CAR OCCUPANTS WEARING SEAT BELTS

HS-017 494

THE INTRODUCTION OF COMPULSORY SEAT BELT WEARING LAWS IN AUSTRALIA AND THEIR EFFECT

HS-017 567

THE SEAT BELT ARGUMENT

HS-017 566

SEATS

ADD-ON BIKE SEATS FOR CHILDREN

HS-017 490

SERIOUS

SERIOUS TRAUMA TO CAR OCCUPANTS WEARING SEAT BELTS

HS-017 494

SERVICE

METHODOLOGIES FOR THE EVALUATION AND IMPROVEMENT OF EMERGENCY MEDICAL SERVICE SYSTEMS. VOL. 2. APPENDICES. FINAL REPORT

HS-801 704

METHODOLOGIES FOR THE EVALUATION AND IMPROVEMENT OF EMERGENCY MEDICAL SERVICE SYSTEMS. VOL. 3. COMPUTERIZED AMBULANCE LOCATION LOGIC USERS MANUAL: PL/I AND FORTRAN VERSIONS. FINAL REPORT

HS-801 705

SHORTAGE

THE EFFECT OF THE FUEL SHORTAGE ON TRAVEL
AND HIGHWAY SAFETY

HS-801 715

SIDEWALL

IDENTIFICATION OF ELASTOMERS IN TIRE SEC-
TIONS BY TOTAL THERMAL ANALYSIS. 2. WHITE
SIDEWALL COMPOUNDS OF EPDM AND BLENDS

HS-017 549

IDENTIFICATION OF ELASTOMERS IN TIRE SEC-
TIONS BY TOTAL THERMAL ANALYSIS. 3. WHITE
SIDEWALL COMPOUNDS OF NEOPRENE RUBBER
BLENDS

HS-017 550

SIGN

DRIVER ROAD SIGN INTERACTION

HS-017 563

ROADWAY SIGN ILLUMINATION

HS-017 468

SIGNAL

TRAFFIC SIGNAL WARRANTS. A BIBLIOGRAPHY

HS-017 492

SIGNS

DRIVER RECALL OF ROADSIDE SIGNS

HS-017 456

SIMULATION

EXPERIMENTAL AND COMPUTER SIMULATION
EVALUATION OF HEADLAMP BEAMS

HS-017 457

THE DEVELOPMENT AND COMPARATIVE EVALUA-
TION OF ANALYTICAL TIRE MODELS FOR DYNAM-
IC VEHICLE SIMULATION. FINAL REPORT

HS-017 548

SIMULATORS

AN EVALUATION OF DRIVER SIMULATORS FOR
SAFETY TRAINING

HS-017 508

SINGLE

REDUCING THE TRANSMITTED VIBRATIONS FROM
SINGLE CYLINDER ENGINES

HS-017 525

SITUATION

THE PERCEPTION OF MANOEUVRES (MANEUVERS)
OF MOVING VEHICLES. PROGRESS REPORT NO. 6.
IMPLICATIONS OF PSYCHOPHYSICAL THRESHOLD
MEASUREMENT FOR THE NIGHT DRIVING SITUA-
TION. FINAL REPORT

HS-017 470

SIZE

ADVANCED PASSIVE RESTRAINT SYSTEM FOR SUB-
COMPACT SIZE VEHICLE FRONT SEAT PASSEN-
GERS. PROGRESS REPORTS 14 AND 15, 4 AUGUST
1975 TO 5 OCTOBER 1975

HS-801 752

SLAP

PISTON SLAP NOISE OF INDIRECT COMBUSTION
DIESEL ENGINE

HS-017 534

SLOPES

EVALUATION OF WHEEL BLOCKING FOR VEHIC-
LES PARKED ON SLOPES

HS-017 5

SOCIAL

ENGINEERING KNOW-HOW IN ENGINE DESIGN
PART 23. ENGINE DESIGN TO MEET NEW SOCIAL
OBLIGATIONS

HS-017 5

SOLID

AUTOMOTIVE SOLID STATE DISPLAYS

HS-017 5

SOVIET

THREE GENERATIONS OF SOVIET WHEELED MILI-
TARY TRANSPORT VEHICLES

HS-017 4

SPECIALIZED

SPECIALIZED ILLUMINATION SYSTEMS FOR
PEDESTRIAN CROSSWALKS

HS-017 4

SPEED

A STUDY OF THE EFFECTS OF THE 55-MPH SPEED
LIMIT

HS-017 4

DRIVER RESPONSE TO THE 55 MPH MAXIMUM
SPEED LIMIT AND THE VARIATIONAL CHARACTER-
ISTICS OF SPOT SPEEDS

HS-017 4

EFFECT OF 55-MPH SPEED LIMIT ON AVERAGE
SPEEDS OF FREE-FLOWING AUTOMOBILES ON A
INTERSTATE BRIDGE IN WEST VIRGINIA

HS-017 3

EFFECTS OF THE ENERGY CRISIS AND 55 MPH
SPEED LIMIT IN MICHIGAN. FINAL REPORT

HS-017 4

EFFECTS OF THE 55 MPH SPEED LIMIT

HS-017 4

HUMAN FACTOR AND HARDWARE DESIGN CON-
SIDERATIONS FOR PASSENGER PROTECTION IN
HIGH SPEED CRASHES

HS-017 3

SPEED CONTROL IN RURAL SCHOOL ZONES

HS-017 3

SPEEDER

TECHNOLOGY SPOTS THE SPEEDER

HS-017 3

SPEEDS

DRIVER RESPONSE TO THE 55 MPH MAXIMUM
SPEED LIMIT AND THE VARIATIONAL CHARACTER-
ISTICS OF SPOT SPEEDS

HS-017 3

EFFECT OF 55-MPH SPEED LIMIT ON AVERAGE
SPEEDS OF FREE-FLOWING AUTOMOBILES ON A
INTERSTATE BRIDGE IN WEST VIRGINIA

HS-017 3

THE PERCEPTION OF VEHICLE SPEEDS BY
PEDESTRIANS

HS-017 3

| | | | |
|---|------------|--|------------|
| SPLLED FUEL IGNITION SOURCES AND COUNTER-MEASURES. SUMMARY REPORT. FINAL REPORT | HS-801 742 | STREETS | HS-017 453 |
| | HS-801 744 | HIGH STRENGTH MATERIALS AND VEHICLE WEIGHT REDUCTION ANALYSIS | HS-017 485 |
| SPOT | | STRETCH | |
| DRIVER RESPONSE TO THE 55 MPH MAXIMUM SPEED LIMIT AND THE VARIATIONAL CHARACTERISTICS OF SPOT SPEEDS | HS-017 464 | SHEET METAL STRETCH FLANGE ANALYSIS: A MANUFACTURING VIEWPOINT | HS-017 440 |
| SPOTS | | STROKE | |
| TECHNOLOGY SPOTS THE SPEEDER | HS-017 429 | LOW NOISE OPPOSED PISTON TWO-STROKE ENGINE AND BLOWER | HS-017 545 |
| STANDARDS | | STRUCTURAL | |
| CONSIDERATIONS IN THE USE OF SAMPLING PLANS FOR EFFECTING COMPLIANCE WITH MANDATORY SAFETY STANDARDS. FINAL REPORT | HS-017 426 | EVALUATING THE EFFECTS OF CORROSION ON STRUCTURAL MATERIALS. A STUDY OF PLAIN, CARBON AND HIGH STRENGTH LOW ALLOY STEELS | HS-017 453 |
| MOTORCYCLE TRAINING--STANDARDS FOR SURVIVAL | HS-017 570 | TECHNIQUES OF STRUCTURAL VIBRATION ANALYSIS APPLIED TO DIESEL ENGINE NOISE REDUCTION | HS-017 540 |
| STANDARDS ENFORCEMENT TEST REPORTS INDEX FOR 1973 | HS-801 663 | STRUCTURE | |
| STATEWIDE | | ANALYSIS AND PREDICTION OF ENGINE STRUCTURE VIBRATION | HS-017 537 |
| STATEWIDE HIGHWAY SAFETY PROGRAM ASSESSMENT. A NATIONAL ESTIMATE OF PERFORMANCE. JULY, 1975 | HS-801 742 | EFFECTS OF GRAPHITE MORPHOLOGY, MATRIX HARDNESS, AND STRUCTURE ON THE FATIGUE RESISTANCE OF GRAY CAST IRON | HS-017 441 |
| STATION | | MODES OF ENGINE STRUCTURE VIBRATION AS A SOURCE OF NOISE | HS-017 538 |
| VEHICLE DIAGNOSTIC STATION | HS-017 433 | STRUGGLE | |
| STEEL | | THE STRUGGLE OVER WHAT'S UP FRONT [THE ARGUMENT ABOUT FRONT AXLE WEIGHT MAXIMUM] | HS-017 576 |
| DEVELOPMENT OF LIGHTWEIGHT DOOR INTRUSION BEAMS UTILIZING AN ULTRA HIGH STRENGTH STEEL | HS-017 486 | STYLE | |
| STEELS | | STYLE, PERSONALITY AND ACCIDENTS | HS-017 500 |
| EVALUATING THE EFFECTS OF CORROSION ON STRUCTURAL MATERIALS. A STUDY OF PLAIN CARBON AND HIGH STRENGTH LOW ALLOY STEELS | HS-017 453 | SUBCOMPACT | |
| STOPS | | ADVANCED PASSIVE RESTRAINT SYSTEM FOR SUBCOMPACT SIZE VEHICLE FRONT SEAT PASSENGERS. PROGRESS REPORTS 14 AND 15, 4 AUGUST 1975 TO 5 OCTOBER 1975 | HS-801 752 |
| A UNIQUE CONCEPT FOR AUTOMATICALLY CONTROLLING THE BRAKING ACTION OF WHEELED VEHICLES DURING MINIMUM DISTANCE STOPS | HS-017 501 | INFLATABLE BELT DEVELOPMENT FOR SUBCOMPACT CAR PASSENGERS. FINAL REPORT | HS-801 719 |
| STRATIFIED | | INFLATABLE BELT DEVELOPMENT FOR SUBCOMPACT CAR PASSENGERS. EXECUTIVE SUMMARY. FINAL REPORT | HS-801 720 |
| PRECHAMBER AND VALVE GEAR DESIGN FOR 3-VALVE STRATIFIED CHARGE ENGINES | HS-017 526 | SUBCOMPACT CAR CRASHWORTHINESS PROGRAM. PROGRESS REPORT FOR JUNE AND JULY, 1975 | HS-801 723 |
| STRENGTH | | | |
| DEVELOPMENT OF LIGHTWEIGHT DOOR INTRUSION BEAMS UTILIZING AN ULTRA HIGH STRENGTH STEEL | HS-017 486 | | |

- PROGRESS REPORT, HS-001 749
HS-001 749
- SUBURBAN**
ASSESSMENT OF PEDESTRIAN ATTITUDES AND
BEHAVIOR IN SUBURBAN ENVIRONMENTS
HS-017 517
- SUPPLY**
MOTOR CARRIER ACCIDENT INVESTIGATION.
WARE OIL AND SUPPLY CO., INC. ACCIDENT--
MARCH 1, 1975--PERRY, FLORIDA
HS-017 478
- SURFACE**
A NOTE ON HEAT GENERATION DUE TO SURFACE
RUBBING
HS-017 497
- SURVIVABILITY**
OCCUPANT SURVIVABILITY IN LATERAL COLLI-
SIONS. PROGRESS REPORTS 7-13, 1 FEBRUARY 1975
TO 31 AUGUST 1975
HS-801 751
- SURVIVAL**
MOTORCYCLE TRAINING--STANDARDS FOR SUR-
VIVAL
HS-017 570
- TASKS**
HIGHWAY METRICATION. VOL. 1. TASKS 1, 2, 3, 4,
AND APERCU. FINAL REPORT
HS-017 483
- TEMPERATURE**
ADVANCES IN LOW TEMPERATURE LIQUID NITRID-
ING
HS-017 438
TEMPERATURE MEASUREMENT FOR ADVANCED
GAS TURBINE CONTROLS
HS-017 445
TEMPERATURE MEASUREMENT FOR GAS TURBINE
ENGINES
HS-017 446
- TESTING**
CONCEPTS IN SAFETY BELT TESTING. FINAL RE-
PORT
HS-017 553
TESTING OF FOREIGN PROTOTYPE EXPERIMENTAL
SAFETY VEHICLES--PROGRAM SUMMARY REPORT.
FINAL REPORT
HS-801 717
- TEXACO**
THE TEXACO IGNITION SYSTEM--A NEW CONCEPT
FOR AUTOMOTIVE ENGINES
HS-017 583
- THERMAL**
IDENTIFICATION OF ELASTOMERS IN TIRE SEC-
TIONS BY TOTAL THERMAL ANALYSIS. 2. WHITE
SIDEWALL COMPOUNDS OF EPDM AND BLENDS
HS-017 549
IDENTIFICATION OF ELASTOMERS IN TIRE SEC-
TIONS BY TOTAL THERMAL ANALYSIS. 3. WHITE
- IDENTIFICATION OF ELASTOMERS IN TIRE SEC-
TIONS BY TOTAL THERMAL ANALYSIS. 4. INNER-
LINER
HS-017 551
- THERMOANALYTICAL**
THERMOANALYTICAL METHODS IN VULCANIZATE
ANALYSIS. 2. DERIVATIVE THERMOGRAVIMETRIC
ANALYSIS
HS-017 552
- THERMOGRAVIMETRIC**
THERMOANALYTICAL METHODS IN VULCANIZATE
ANALYSIS. 2. DERIVATIVE THERMOGRAVIMETRIC
ANALYSIS
HS-017 552
- THORACIC**
THORACIC IMPACT INJURY MECHANISM. VOL. 1.
FINAL REPORT
HS-801 710
THORACIC IMPACT INJURY MECHANISM. VOL. 2.
[APPENDICES.] FINAL REPORT
HS-801 711
- THRESHOLD**
THE PERCEPTION OF MANOEUVRES [MANEUVERS]
OF MOVING VEHICLES. PROGRESS REPORT NO. 6.
IMPLICATIONS OF PSYCHOPHYSICAL THRESHOLD
MEASUREMENT FOR THE NIGHT DRIVING SITUA-
TION. FINAL REPORT
HS-017 470
- TIME**
METHOD OF CHECKING AND ADJUSTING BRAKES
OF THE GAZ-21 ON THE BASIS OF BRAKING TIME
HS-017 455
- TIPS**
TIPS ON CAR CARE AND SAFETY FOR DEAF
DRIVERS
HS-801 757
- TIRE**
FULL SCALE CRASH TESTS OF A TIRE-SAND INER-
TIA BARRIER. INTERIM REPORT
HS-017 462
IDENTIFICATION OF ELASTOMERS IN TIRE SEC-
TIONS BY TOTAL THERMAL ANALYSIS. 2. WHITE
SIDEWALL COMPOUNDS OF EPDM AND BLENDS
HS-017 549
IDENTIFICATION OF ELASTOMERS IN TIRE SEC-
TIONS BY TOTAL THERMAL ANALYSIS. 3. WHITE
SIDEWALL COMPOUNDS OF NEOPRENE RUBBER
BLENDS
HS-017 550
IDENTIFICATION OF ELASTOMERS IN TIRE SEC-
TIONS BY TOTAL THERMAL ANALYSIS. 4. INNER-
LINER
HS-017 551
THE DEVELOPMENT AND COMPARATIVE EVALUA-
TION OF ANALYTICAL TIRE MODELS FOR DYNAM-
IC VEHICLE SIMULATION. FINAL REPORT
HS-017 548

TIRE-PAVEMENT FRICTION AS A FUNCTION OF VEHICLE MANEUVERS. FINAL REPORT
HS-017 427

UNIFORM TIRE QUALITY GRADING--TREADWEAR. CITY TEST. FINAL REPORT
HS-801 735

TIRES
EFFECTS OF INTERMIXING OF BIAS, BIAS BELTED, AND RADIAL PLY PASSENGER TIRES ON VEHICLE DYNAMICS AND DRIVER/VEHICLE RESPONSES. FINAL REPORT
HS-801 702

MOTION RESISTANCE OF PNEUMATIC TYRES [TIRES]
HS-017 581

ROLLING RESISTANCE OF PNEUMATIC TIRES. INTERIM REPORT
HS-017 519

TOYOTA
ACCIDENT AVOIDANCE TEST REPORT--NISSAN AND TOYOTA EXPERIMENTAL SAFETY VEHICLES. FINAL TEST REPORT
HS-801 713

TRAFFIC
ANALYSIS OF METHODOLOGY FOR MEASURING NATIONAL HIGHWAY TRAFFIC SAFETY. FINAL REPORT
HS-801 741

MODEL POLICE TRAFFIC SERVICES, POLICIES, PROCEDURES, RULES, AND REGULATIONS. MANUAL. PHASE 2. MODEL POLICE TRAFFIC SERVICES PROCEDURES
HS-801 734

PROBLEMS, PROGRESS AND GOALS IN TRAFFIC SAFETY [PANEL DISCUSSION]
HS-017 573

REFLECTORISED NUMBER (LICENCE) PLATES [REFLECTORIZED LICENSE PLATES] AND TRAFFIC SAFETY IN AUSTRALIA
HS-017 518

STATEMENT BEFORE THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA) AT THE PUBLIC MEETING ON STANDARD NO. 208, OCCUPANT CRASH PROTECTION, HELD MAY 19, 1975
HS-017 506

TRAFFIC ACCIDENT FACTS, 1974 (FLORIDA). AN ILLUSTRATED ANALYSIS OF ACCIDENT RECORDS
HS-017 473

TRAFFIC SAFETY '74. A REPORT ON ACTIVITIES UNDER THE HIGHWAY SAFETY ACT OF 1966
HS-801 699

TRAFFIC SAFETY '74. A REPORT ON ACTIVITIES UNDER THE NATIONAL TRAFFIC AND MOTOR VEHICLE SAFETY ACT OF 1966 AND THE MOTOR VEHICLE INFORMATION AND COST SAVINGS ACT OF 1972.
HS-801 700

TRAFFIC SAFETY. PROCEEDINGS OF THE SCIENTIFIC CONFERENCE, OTTAWA, ONTARIO, CANADA, MAY 23 AND 24, 1974
HS-017 559

TRAFFIC SIGNAL WARRANTS. A BIBLIOGRAPHY
HS-017 492

USER MANUAL FOR THE TRAFFIC ACCIDENT RECORDING MODULE
HS-017 435

TRAINING
AN EVALUATION OF DRIVER SIMULATORS FOR SAFETY TRAINING
HS-017 508

MOTORCYCLE TRAINING FOR CALIFORNIA DRIVER LICENSING PERSONNEL. FINAL REPORT
HS-017 459

MOTORCYCLE TRAINING--STANDARDS FOR SURVIVAL
HS-017 570

POLICE MANAGEMENT TRAINING. FACTORS INFLUENCING DWI ARRESTS. FINAL TECHNICAL REPORT
HS-801 731

TRANSIT
NEW TRANSIT MODES: APPLICABILITY AND CURRENT STATUS
HS-017 449

SAFETY IN MASS TRANSIT: A CASE STUDY OF BUS ACCIDENTS IN WASHINGTON, D.C.
HS-017 504

TRANSMISSIONS
THE EFFECT OF AUTOMATIC TRANSMISSIONS ON MILITARY TRUCK FUEL ECONOMY
HS-017 450

TRANSMITTED
REDUCING THE TRANSMITTED VIBRATIONS FROM SINGLE CYLINDER ENGINES
HS-017 525

TRANSPORT
THREE GENERATIONS OF SOVIET WHEELED MILITARY TRANSPORT VEHICLES
HS-017 452

TRANSPORTATION
PASSENGER NOISE ENVIRONMENTS OF ENCLOSED TRANSPORTATION SYSTEMS
HS-017 521

THE LIGHT DUTY DIESEL ENGINE FOR PRIVATE TRANSPORTATION
HS-017 488

THE TRANSPORTATION INDUSTRY CONFERENCE ON INFLATION, LOS ANGELES, CALIFORNIA, SEPTEMBER 19-20, 1974
HS-017 505

TRANSPORTATION PROGRAMMING PROCESS.
PROCEEDINGS OF A CONFERENCE, ORLANDO,
FLORIDA, 23-26 MARCH 1975.

HS-017 482

TRANSVERSE

TRANSVERSE MOVEMENT ANALYSIS AND ITS IN-
FLUENCE ON DIESEL PISTON DESIGN

HS-017 533

TRAUMA

SERIOUS TRAUMA TO CAR OCCUPANTS WEARING
SEAT BELTS

HS-017 494

TRAVEL

THE EFFECT OF THE FUEL SHORTAGE ON TRAVEL
AND HIGHWAY SAFETY

HS-801 715

TREAD

ESTABLISHMENT AND CALIBRATION OF A TREAD
WEAR TEST COURSE

HS-017 496

TREADWEAR

UNIFORM TIRE QUALITY GRADING--TREADWEAR.
CITY TEST. FINAL REPORT

HS-801 735

TRENDS

EMISSION FORMATION CHARACTERISTICS OF THE
DIESEL COMBUSTION PROCESS AND ESTIMATED
FUTURE DEVELOPMENT TRENDS

HS-017 524

TRUCK

THE EFFECT OF AUTOMATIC TRANSMISSIONS ON
MILITARY TRUCK FUEL ECONOMY

HS-017 450

1975 MOTOR TRUCK FACTS

HS-017 557

TRUCK/AUTO/GREYHOUND

HIGHWAY ACCIDENT REPORT. GEORGE WOLLMAN
MEATS, INC., TRUCK/AUTO/GREYHOUND BUS COL-
LISION AND FIRE, NEW JERSEY TURNPIKE, BOR-
DENTOWN, NEW JERSEY, OCTOBER 19, 1973

HS-017 491

TUNNELS

VISIBILITY STUDY FOR LONG VEHICULAR TUN-
NELS

HS-017 466

TURBINE

PERFORMANCE AND APPLICATION OF THE EX-
DUCER POWER TURBINE

HS-017 447

TEMPERATURE MEASUREMENT FOR ADVANCED
GAS TURBINE CONTROLS

HS-017 445

TEMPERATURE MEASUREMENT FOR GAS TURBINE
ENGINES

HS-017 446

TURBOCHARGING

EFFECT OF TURBOCHARGING ON DIESEL ENGINE
NOISE, EMISSIONS AND PERFORMANCE

HS-017 530

TURN

RIGHT-TURN-ON-RED: CURRENT PRACTICES AND
STATE-OF-THE-ART. INTERIM REPORT

HS-017 503

TURNPIKE

HIGHWAY ACCIDENT REPORT. GEORGE WOLLMAN
MEATS, INC., TRUCK/AUTO/GREYHOUND BUS COL-
LISION AND FIRE, NEW JERSEY TURNPIKE, BOR-
DENTOWN, NEW JERSEY, OCTOBER 19, 1973

HS-017 491

ULTRA

DEVELOPMENT OF LIGHTWEIGHT DOOR INTRU-
SION BEAMS UTILIZING AN ULTRA HIGH
STRENGTH STEEL

HS-017 486

UNIQUE

A UNIQUE CONCEPT FOR AUTOMATICALLY CON-
TROLLING THE BRAKING ACTION OF WHEELED
VEHICLES DURING MINIMUM DISTANCE STOPS

HS-017 501

URBAN

EFFECTS OF INCREASED ENFORCEMENT AT
URBAN INTERSECTIONS ON DRIVER BEHAVIOR
AND SAFETY

HS-017 515

USER

USER MANUAL FOR THE TRAFFIC ACCIDENT
RECORDING MODULE

HS-017 435

USERS

METHODOLOGIES FOR THE EVALUATION AND IM-
PROVEMENT OF EMERGENCY MEDICAL SERVICE
SYSTEMS. VOL. 3. COMPUTERIZED AMBULANCE
LOCATION LOGIC USERS MANUAL: PL/I AND FOR-
TRAN VERSIONS. FINAL REPORT

HS-801 705

VALUE

THE PROTECTIVE VALUE OF CONTEMPORARY MO-
TORCYCLE HELMETS IN THE PREVENTION OF
HEAD INJURIES

HS-017 569

VALVE

PRECHAMBER AND VALVE GEAR DESIGN FOR 3-
VALVE STRATIFIED CHARGE ENGINES

HS-017 526

VARIABILITY

TEST VARIABILITY OF EMISSION AND FUEL
ECONOMY MEASUREMENTS USING THE 1975
FEDERAL TEST PROCEDURE

HS-017 437

VARIABLES

ACCIDENT CHANGES UNDER ENERGY CRISIS RE-

VARIATIONAL
DRIVER RESPONSE TO THE 55 MPH MAXIMUM
SPEED LIMIT AND THE VARIATIONAL CHARAC-
TERISTICS OF SPOT SPEEDS

HS-017 464

VEHICLE

A CYBERNETICALLY COUPLED RESEARCH VEHIC-
LE [CCRV]

HS-017 451

A SURVEY OF MOTOR VEHICLE BURN ACCIDENTS
IN CHILDREN: REPORT OF 45 CASES

HS-017 499

ADVANCED PASSIVE RESTRAINT SYSTEM FOR SUB-
COMPACT SIZE VEHICLE FRONT SEAT PASSEN-
GERS. PROGRESS REPORTS 14 AND 15, 4 AUGUST
1975 TO 5 OCTOBER 1975

HS-801 752

AUTOMATIC VEHICLE CONTROLLER. OPERATOR'S
AND MAINTENANCE MANUAL

HS-801 716

DRIVER PERFORMANCE RELATED TO THE VEHIC-
LE

HS-017 564

EFFECTS OF INTERMIXING OF BIAS, BIAS BELTED,
AND RADIAL PLY PASSENGER TIRES ON VEHICLE
DYNAMICS AND DRIVER/VEHICLE RESPONSES.
FINAL REPORT

HS-801 702

FACTORS CONTRIBUTING TO THE REDUCTION OF
MOTOR VEHICLE FATALITIES IN 1974

HS-017 509

HIGH STRENGTH MATERIALS AND VEHICLE
WEIGHT REDUCTION ANALYSIS

HS-017 485

INTERACTIONS OF OCCUPANT AGE, VEHICLE
WEIGHT, AND THE PROBABILITY OF DYING IN A
TWO-VEHICLE CRASH

HS-017 472

MOTOR VEHICLE SAFETY DEFECT RECALL CAM-
PAIGNS--DETAILED REPORTS FROM APRIL 1 TO
JUNE 30, 1975

HS-801 662

REAR-IMPACTED VEHICLE COLLISIONS: FREQUEN-
CIES AND CASUALTY PATTERNS. FINAL REPORT

HS-017 461

RESEARCH SAFETY VEHICLE (RSV). PHASE 2.
STATUS REPORT NO. 1

HS-801 730

RESTRAINT USE AND EFFECTIVENESS IN REAL-
WORLD CRASHES; FEW CHILDREN PROTECTED IN
CARS; [AND] PAPERS RELEVANT TO FEDERAL
MOTOR VEHICLE SAFETY

HS-017 507

THE DEVELOPMENT AND COMPARATIVE EVALUA-
TION OF ANALYTICAL TIRE MODELS FOR DYNAM-
IC VEHICLE SIMULATION. FINAL REPORT

HS-017 548

THE PERCEPTION OF VEHICLE SPEEDS BY
PEDESTRIANS

HS-017 432

THE PROBLEMS OF NOISE OF ENGINES IN DIF-
FERENT VEHICLE GROUPS

HS-017 528

TIRE-PAVEMENT FRICTION AS A FUNCTION OF
VEHICLE MANEUVERS. FINAL REPORT

HS-017 427

TRAFFIC SAFETY '74. A REPORT ON ACTIVITIES
UNDER THE NATIONAL TRAFFIC AND MOTOR
VEHICLE SAFETY ACT OF 1966 AND THE MOTOR
VEHICLE INFORMATION AND COST SAVINGS ACT
OF 1972.

HS-801 700

VEHICLE DIAGNOSTIC STATION

HS-017 433

VEHICLES

A UNIQUE CONCEPT FOR AUTOMATICALLY CON-
TROLLING THE BRAKING ACTION OF WHEELED
VEHICLES DURING MINIMUM DISTANCE STOPS

HS-017 501

ACCIDENT AVOIDANCE TEST REPORT--NISSAN AND
TOYOTA EXPERIMENTAL SAFETY VEHICLES.
FINAL TEST REPORT

HS-801 713

EVALUATION OF WHEEL BLOCKING FOR VEHIC-
LES PARKED ON SLOPES

HS-017 511

TESTING OF FOREIGN PROTOTYPE EXPERIMENTAL
SAFETY VEHICLES--PROGRAM SUMMARY REPORT.
FINAL REPORT

HS-801 717

THE PERCEPTION OF MANOEUVRES [MANEUVERS]
OF MOVING VEHICLES. PROGRESS REPORT NO. 6.
IMPLICATIONS OF PSYCHOPHYSICAL THRESHOLD
MEASUREMENT FOR THE NIGHT DRIVING SITUA-
TION. FINAL REPORT

HS-017 470

THREE GENERATIONS OF SOVIET WHEELED MILI-
TARY TRANSPORT VEHICLES

HS-017 452

VEHICULAR

VISIBILITY STUDY FOR LONG VEHICULAR TUN-
NELS

HS-017 466

VIBRATION

ANALYSIS AND PREDICTION OF ENGINE STRUC-
TURE VIBRATION

HS-017 537

MODES OF ENGINE STRUCTURE VIBRATION AS A
SOURCE OF NOISE

HS-017 538

SIMPLE MODEL TECHNIQUE FOR BETTER UN-
DERSTANDING OF DIESEL ENGINE VIBRATION
AND NOISE

HS-017 539

TECHNIQUES OF STRUCTURAL VIBRATION ANALY-
SIS APPLIED TO DIESEL ENGINE NOISE REDUC-
TION

HS-017 540

TIRE VIBRATION STUDIES: THE STATE OF THE ART

HS-017 498

VIBRATIONS

REDUCING THE TRANSMITTED VIBRATIONS FROM
SINGLE CYLINDER ENGINES

HS-017 525

VIRGINIA

EFFECT OF 55-MPH SPEED LIMIT ON AVERAGE SPEEDS OF FREE-FLOWING AUTOMOBILES ON AN INTERSTATE BRIDGE IN WEST VIRGINIA

HS-017 575

VISIBILITY

EFFECT OF PASSENGER LOADING ON DRIVER'S VISIBILITY [FIELD OF VIEW] FROM AUTOMOBILES

HS-801 743

VISIBILITY STUDY FOR LONG VEHICULAR TUNNELS

HS-017 466

VISION

INTERINDIVIDUAL DIFFERENCES IN MESOPIC NIGHT VISION ABILITY MEASURED BY THE MESOPTOMETER

HS-017 481

VULCANIZATE

THERMOANALYTICAL METHODS IN VULCANIZATE ANALYSIS. 2. DERIVATIVE THERMOGRAVIMETRIC ANALYSIS

HS-017 552

WARE

MOTOR CARRIER ACCIDENT INVESTIGATION. WARE OIL AND SUPPLY CO., INC. ACCIDENT--MARCH 1, 1975--PERRY, FLORIDA

HS-017 478

WARRANTS

TRAFFIC SIGNAL WARRANTS. A BIBLIOGRAPHY

HS-017 492

WASHINGTON

SAFETY IN MASS TRANSIT: A CASE STUDY OF BUS ACCIDENTS IN WASHINGTON, D.C.

HS-017 504

STATEMENT OF THE STATE OF ILLINOIS IN RESPONSE TO THE HIGHWAY SAFETY SANCTION HEARING, WASHINGTON, D.C., SEPTEMBER 30, 1975

HS-017 502

WASTE

CRASH CUSHIONS OF WASTE MATERIALS

HS-017 430

WEAR

ESTABLISHMENT AND CALIBRATION OF A TREAD WEAR TEST COURSE

HS-017 496

WEARING

SERIOUS TRAUMA TO CAR OCCUPANTS WEARING SEAT BELTS

HS-017 494

THE INTRODUCTION OF COMPULSORY SEAT BELT WEARING LAWS IN AUSTRALIA AND THEIR EFFECT

HS-017 567

WEIGHT

HIGH STRENGTH MATERIALS AND VEHICLE WEIGHT REDUCTION ANALYSIS

HS-017 485

INTERACTIONS OF OCCUPANT AGE, VEHICLE WEIGHT, AND THE PROBABILITY OF DYING IN A TWO-VEHICLE CRASH

HS-017 472

THE STRUGGLE OVER WHAT'S UP FRONT [THE ARGUMENT ABOUT FRONT AXLE WEIGHT MAXIMUM]

HS-017 576

WHEEL

EVALUATION OF WHEEL BLOCKING FOR VEHICLES PARKED ON SLOPES

HS-017 511

WHEELED

A UNIQUE CONCEPT FOR AUTOMATICALLY CONTROLLING THE BRAKING ACTION OF WHEELED VEHICLES DURING MINIMUM DISTANCE STOPS

HS-017 501

THREE GENERATIONS OF SOVIET WHEELED MILITARY TRANSPORT VEHICLES

HS-017 452

WHITE

IDENTIFICATION OF ELASTOMERS IN TIRE SECTIONS BY TOTAL THERMAL ANALYSIS. 2. WHITE SIDEWALL COMPOUNDS OF EPDM AND BLENDS

HS-017 549

IDENTIFICATION OF ELASTOMERS IN TIRE SECTIONS BY TOTAL THERMAL ANALYSIS. 3. WHITE SIDEWALL COMPOUNDS OF NEOPRENE RUBBER BLENDS

HS-017 550

WOLLMAN

HIGHWAY ACCIDENT REPORT. GEORGE WOLLMAN MEATS, INC., TRUCK/AUTO/GREYHOUND BUS COLLISION AND FIRE, NEW JERSEY TURNPIKE, BORDENTOWN, NEW JERSEY, OCTOBER 19, 1973

HS-017 491

WORK

DELAYED EFFECTS OF ACUTE ALCOHOLIC INTOXICATION ON PERFORMANCE WITH REFERENCE TO WORK SAFETY

HS-017 510

ZONES

SPEED CONTROL IN RURAL SCHOOL ZONES

HS-017 577

Author Index

- Abston, Sally**
A SURVEY OF MOTOR VEHICLE BURN ACCIDENTS
IN CHILDREN: REPORT OF 45 CASES
HS-017 499
- Adams, D. G.**
HIGH STRENGTH MATERIALS AND VEHICLE
WEIGHT REDUCTION ANALYSIS
HS-017 485
- Agent, Kenneth R.**
RELATIONSHIPS BETWEEN ROADWAY GEOMET-
RICS AND ACCIDENTS
HS-017 578
- Aisaka, Masaharu**
SIMPLE MODEL TECHNIQUE FOR BETTER UN-
DERSTANDING OF DIESEL ENGINE VIBRATION
AND NOISE
HS-017 539
- Anderkay, G. A.**
TECHNIQUES FOR QUIETING THE DIESEL
HS-017 544
- Ander-ton, D.**
EFFECT OF TURBOCHARGING ON DIESEL ENGINE
NOISE, EMISSIONS AND PERFORMANCE
HS-017 530
- Andrews, Robert B.**
METHODOLOGIES FOR THE EVALUATION AND IM-
PROVEMENT OF EMERGENCY MEDICAL SERVICE
SYSTEMS. VOL. 2. APPENDICES. FINAL REPORT
HS-801 704
- Attwood, Dennis A.**
DRIVER PERFORMANCE RELATED TO THE VEHI-
CLE
HS-017 564
- Austin, Robert L.**
DRIVER PERCEPTION OF PEDESTRIAN CON-
SPICUOUSNESS UNDER STANDARD HEADLIGHT
[HEADLAMP] ILLUMINATION
HS-017 516
- Badgley, Robert H.**
EARLY DETECTION OF DEFECTS IN ROLLING-ELE-
MENT BEARINGS
HS-017 448
- Barker, J. L.**
TRAFFIC SIGNAL WARRANTS. A BIBLIOGRAPHY
HS-017 492
- Barnes-Moss, H. W.**
THE LIGHT DUTY DIESEL ENGINE FOR PRIVATE
TRANSPORTATION
HS-017 488
- Barthlome, Donald E.**
A UNIQUE CONCEPT FOR AUTOMATICALLY CON-
TROLLING THE BRAKING ACTION OF WHEELED
VEHICLES DURING MINIMUM DISTANCE STOPS
HS-017 501
- Barton, F. W.**
ESTABLISHMENT AND CALIBRATION OF A TREAD
WEAR TEST COURSE
HS-017 496
- Basham, William**
SPEED CONTROL IN RURAL SCHOOL ZONES
HS-017 577
- Beck, Ronald R.**
A CYBERNETICALLY COUPLED RESEARCH VEHI-
CLE [CCRV]
HS-017 451
- Bekker, M. G.**
MOTION RESISTANCE OF PNEUMATIC TYRES
[TIRES]
HS-017 581
- Bergman, W.**
TIRE CORNERING PROPERTIES
HS-017 495
- Besch, L. , Jr.**
HIGHWAY METRICATION. VOL. 1. TASKS 1, 2, 3, 4,
AND APERCU. FINAL REPORT
HS-017 483
HIGHWAY METRICATION. VOL. 2. APPENDIXES.
FINAL REPORT
HS-017 484
- Bettman, James R.**
METHODOLOGIES FOR THE EVALUATION AND IM-
PROVEMENT OF EMERGENCY MEDICAL SERVIC
SYSTEMS. VOL. 2. APPENDICES. FINAL REPORT
HS-801 704
- Bischoff, W. W.**
AUTOMOTIVE SOLID STATE DISPLAYS
HS-017 579
- Bishara, A. G.**
HIGHWAY METRICATION. VOL. 1. TASKS 1, 2, 3, 4,
AND APERCU. FINAL REPORT
HS-017 483
HIGHWAY METRICATION. VOL. 2. APPENDIXES.
FINAL REPORT
HS-017 484
- Bishop, Edward W.**
POLICE MANAGEMENT TRAINING. FACTORS IN-
FLUENCING DWI ARRESTS. FINAL TECHNICAL RE-
PORT
HS-801 731
- Borden, M. P.**
SHEET METAL STRETCH FLANGE ANALYSIS: A
MANUFACTURING VIEWPOINT
HS-017 440
- Boulay, P.**
ACCIDENT AVOIDANCE TEST REPORT--NISSAN AND
TOYOTA EXPERIMENTAL SAFETY VEHICLES.
FINAL TEST REPORT
HS-801 713

TESTING OF FOREIGN PROTOTYPE EXPERIMENTAL
SAFETY VEHICLES--PROGRAM SUMMARY REPORT.
FINAL REPORT

HS-801 717

Brazier, D. W.

THERMOANALYTICAL METHODS IN VULCANIZATE
ANALYSIS. 2. DERIVATIVE THERMOGRAVIMETRIC
ANALYSIS

HS-017 552

Brenner, F. C.

ESTABLISHMENT AND CALIBRATION OF A TREAD
WEAR TEST COURSE

HS-017 496

Broering, L. C.

COOPERATIVE EVALUATION OF TECHNIQUES FOR
MEASURING NITRIC OXIDE AND CARBON MONOX-
IDE (PHASE 4 TESTS)

HS-017 443

CRC EVALUATION OF TECHNIQUES FOR MEASUR-
ING HYDROCARBONS IN DIESEL EXHAUST. PHASE
4

HS-017 442

Broussalian, V. L.

CONSIDERATIONS IN THE USE OF SAMPLING
PLANS FOR EFFECTING COMPLIANCE WITH MAN-
DATORY SAFETY STANDARDS. FINAL REPORT

HS-017 426

Brown, Peggy

EVALUATING THE EFFECTIVENESS OF REEDUCA-
TION PROGRAMS FOR CONVICTED [ALCOHOL] IM-
PAIRED DRIVERS

HS-017 458

Bryant, P. J.

THE DEVELOPMENT OF TECHNOLOGY FOR DETEC-
TION OF MARIJUANA INTOXICATION BY ANALYSIS
OF BODY FLUIDS. FINAL REPORT

HS-801 721

Buth, C. E.

CRASH CUSHIONS OF WASTE MATERIALS

HS-017 430

Byington, Stanley R.

SPEED CONTROL IN RURAL SCHOOL ZONES

HS-017 577

Byrne, Bernard F.

EFFECT OF 55-MPH SPEED LIMIT ON AVERAGE
SPEEDS OF FREE-FLOWING AUTOMOBILES ON AN
INTERSTATE BRIDGE IN WEST VIRGINIA

HS-017 575

Campbell, Gordon D. , moderator

PROBLEMS, PROGRESS AND GOALS IN TRAFFIC
SAFETY [PANEL DISCUSSION]

HS-017 573

Canup, R. E.

THE TEXACO IGNITION SYSTEM--A NEW CONCEPT
FOR AUTOMOTIVE ENGINES

Captain, Khushroo M.

THE DEVELOPMENT AND COMPARATIVE EVALUA-
TION OF ANALYTICAL TIRE MODELS FOR DYNAM-
IC VEHICLE SIMULATION. FINAL REPORT

HS-017 5

Carrelli, Ezio C.

THE EFFECT OF THE FUEL SHORTAGE ON TRAVE-
L AND HIGHWAY SAFETY

HS-801 7

Challen, Bernard J.

THE EFFECT OF COMBUSTION SYSTEM ON ENGIN-
NOISES

HS-017 5

Charles, James W.

SPECIALIZED ILLUMINATION SYSTEMS FO-
PEDESTRIAN CROSSWALKS

HS-017 4

Charles, Seymour

CHILDREN AS PASSENGERS IN AUTOMOBILES: TH-
NEGLECTED MINORITY ON THE NATION-
HIGHWAYS

HS-017 4

Chatterton, N. E.

EVALUATION OF GLARE REDUCTION
TECHNIQUES. FINAL REPORT

HS-801 7

Clark, S. K.

A NOTE ON HEAT GENERATION DUE TO SURFAC-
RUBBING

HS-017 4

Clarke, S. K.

ROLLING RESISTANCE OF PNEUMATIC TIRES. I-
TERIM REPORT

HS-017 5

Clemett, H. R.

TIRE CORNERING PROPERTIES

HS-017 4

Colburn, H. N.

DRUGS (OTHER THAN ALCOHOL) AND DRIVING

HS-017 5

Compton, Charles P.

REAR-IMPACTED VEHICLE COLLISIONS: FREQUE-
NCIES AND CASUALTY PATTERNS. FINAL REPORT

HS-017 4

Compton, W. A.

TEMPERATURE MEASUREMENT FOR ADVANC-
GAS TURBINE CONTROLS

HS-017 4

Cooper, Peter J.

EFFECTS OF INCREASED ENFORCEMENT /
URBAN INTERSECTIONS ON DRIVER BEHAVIO-
AND SAFETY

HS-017 5

Crow, Alexander P.

| | |
|--|--|
| Csora, I. I. TIRE VIBRATION STUDIES: THE STATE OF THE ART HS-017 498 | Dodge, R. N. ROLLING RESISTANCE OF PNEUMATIC TIRES INTERIM REPORT HS-017 519 |
| Culp, T. B. HIGHWAY METRICATION. VOL. 1. TASKS 1, 2, 3, 4, AND APERCU. FINAL REPORT HS-017 483 HIGHWAY METRICATION. VOL. 2. APPENDIXES. FINAL REPORT HS-017 484 | Driscoll, P. THE DEVELOPMENT OF TECHNOLOGY FOR DETEC- TION OF MARIJUANA INTOXICATION BY ANALYSIS OF BODY FLUIDS. FINAL REPORT HS-801 721 |
| Darlow, Mark S. EARLY DETECTION OF DEFECTS IN ROLLING-ELE- MENT BEARINGS HS-017 448 | Dueker, Richard L. SURVEY OF SAFETY RELATED CONDITIONS IN SCHOOL BUSES. FINAL REPORT HS-801 659 |
| Davis, K. B. UNIFORM TIRE QUALITY GRADING--TREADWEAR. CITY TEST. FINAL REPORT HS-801 735 | Duffy, T. E. TEMPERATURE MEASUREMENT FOR ADVANCED GAS TURBINE CONTROLS HS-017 445 |
| Davis, Louis E. METHODOLOGIES FOR THE EVALUATION AND IMP- ROVEMENT OF EMERGENCY MEDICAL SERVICE SYSTEMS. VOL. 2. APPENDICES. FINAL REPORT HS-801 704 | Duggal, V. K. EFFECT OF TURBOCHARGING ON DIESEL ENGINE NOISE, EMISSIONS AND PERFORMANCE HS-017 530 |
| Davis, S. TESTING OF FOREIGN PROTOTYPE EXPERIMENTAL SAFETY VEHICLES--PROGRAM SUMMARY REPORT. FINAL REPORT HS-801 717 | Dunn, A. R. EVALUATION OF GLARE REDUCTION TECHNIQUES. FINAL REPORT HS-801 718 |
| Deen, Robert C. RELATIONSHIPS BETWEEN ROADWAY GEOMET- RICS AND ACCIDENTS HS-017 578 | Egbert, Tim INFLATABLE BELT DEVELOPMENT FOR SUBCOM- PACT CAR PASSENGERS. FINAL REPORT HS-801 719 INFLATABLE BELT DEVELOPMENT FOR SUBCOM- PACT CAR PASSENGERS. EXECUTIVE SUMMARY. FINAL REPORT HS-801 720 |
| Demetsky, Michael J. ASSESSMENT OF PEDESTRIAN ATTITUDES AND BEHAVIOR IN SUBURBAN ENVIRONMENTS HS-017 517 | Elms, Charles P. NEW TRANSIT MODES: APPLICABILITY AND CUR- RENT STATUS HS-017 449 |
| Demidov, V. VEHICLE DIAGNOSTIC STATION HS-017 433 | Erb, R. A. THORACIC IMPACT INJURY MECHANISM. VOL. 1. FINAL REPORT HS-801 710 THORACIC IMPACT INJURY MECHANISM. VOL. 2. [APPENDICIES.] FINAL REPORT HS-801 711 |
| Denholt, Michael J. THE NEW AIR BRAKE SYSTEMS--AN IMPACT OVER- VIEW HS-017 558 | Evans, E. Burke A SURVEY OF MOTOR VEHICLE BURN ACCIDENTS IN CHILDREN: REPORT OF 45 CASES HS-017 499 |
| Dewar, Robert E. DRIVER ROAD SIGN INTERACTION HS-017 563 | Fachbach, Heinz A. DESIGN CONCEPTS OF DIESEL ENGINES WITH LOW NOISE EMISSION HS-017 543 |
| Dinda, S. DEVELOPMENT OF LIGHTWEIGHT DOOR INTRU- SION BEAMS UTILIZING AN ULTRA HIGH STRENGTH STEEL HS-017 486 | Farrar, A. J. CONSIDERATIONS IN THE USE OF SAMPLING PLANS FOR EFFECTING COMPLIANCE WITH MAN- DATORY SAFETY STANDARDS. FINAL REPORT HS-017 426 |
| DiCello, J. A. HIGH STRENGTH MATERIALS AND VEHICLE WEIGHT REDUCTION ANALYSIS HS-017 485 | |

- CIES AND CASUALTY PATTERNS. FINAL REPORT
HS-017 461
- Fine, T. E.**
DEVELOPMENT OF LIGHTWEIGHT DOOR INTRU-
SION BEAMS UTILIZING AN ULTRA HIGH
STRENGTH STEEL
HS-017 486
- Fischer, D.**
EUROPEAN APPROACH TO THE LUMINANCE
ASPECT OF ROADWAY LIGHTING
HS-017 467
- Fitzpatrick, Michael**
INFLATABLE BELT DEVELOPMENT FOR SUBCOM-
PACT CAR PASSENGERS. FINAL REPORT
HS-801 719
- INFLATABLE BELT DEVELOPMENT FOR SUBCOM-
PACT CAR PASSENGERS. EXECUTIVE SUMMARY.
FINAL REPORT
HS-801 720
- Fitzsimmons, James A.**
METHODOLOGIES FOR THE EVALUATION AND IM-
PROVEMENT OF EMERGENCY MEDICAL SERVICE
SYSTEMS. VOL. 3. COMPUTERIZED AMBULANCE
LOCATION LOGIC USERS MANUAL: PL/I AND FOR-
TRAN VERSIONS. FINAL REPORT
HS-801 705
- Freedman, Mark**
SPECIALIZED ILLUMINATION SYSTEMS FOR
PEDESTRIAN CROSSWALKS
HS-017 465
- Gan, O. H. M.**
THE DEVELOPMENT OF TECHNOLOGY FOR DETEC-
TION OF MARIJUANA INTOXICATION BY ANALYSIS
OF BODY FLUIDS. FINAL REPORT
HS-801 721
- Ganter, R. J.**
ROLLING RESISTANCE OF PNEUMATIC TIRES. IN-
TERIM REPORT
HS-017 519
- Gardner, James A.**
DESIGN AND IMPLEMENTATION OF A SYSTEM TO
RECORD DRIVER LATERAL POSITIONING
HS-017 574
- Garland, B. H.**
DRUGS (OTHER THAN ALCOHOL) AND DRIVING
HS-017 561
- Gemma, William R.**
AN EVALUATION METHODOLOGY FOR EMERGEN-
CY MEDICAL SERVICES
HS-017 571
- Glater, David S.**
TECHNOLOGY SPOTS THE SPEEDER
HS-017 429
- Gloyns, P. F.**
SERIOUS TRAUMA TO CAR OCCUPANTS WEARING
SEAT BELTS
HS-017 494
- Goldblatt, R. B.**
RELATIONSHIP OF ACCIDENT PATTERNS TO TYPE
OF INTERSECTION CONTROL
HS-017 514
- Golding, J. M.**
HIGHWAY METRICATION. VOL. 1. TASKS 1, 2, 3, 4,
AND APERCU. FINAL REPORT
HS-017 483
- HIGHWAY METRICATION. VOL. 2. APPENDIXES.
FINAL REPORT
HS-017 484
- Golomb, Dan H.**
EFFECTS OF THE ENERGY CRISIS AND 55 MPH
SPEED LIMIT IN MICHIGAN. FINAL REPORT
HS-017 463
- Goodwin, P. B.**
THE PERCEPTION OF VEHICLE SPEEDS BY
PEDESTRIANS
HS-017 432
- Grande, Edvard**
THE DEVELOPMENT AND COMPARATIVE EVALUA-
TION OF ANALYTICAL TIRE MODELS FOR DYNAM-
IC VEHICLE SIMULATION. FINAL REPORT
HS-017 548
- Granit, Ronald K.**
METHODOLOGIES FOR THE EVALUATION AND IM-
PROVEMENT OF EMERGENCY MEDICAL SERVICE
SYSTEMS. VOL. 2. APPENDICES. FINAL REPORT
HS-801 704
- Griffiths, D. K.**
SERIOUS TRAUMA TO CAR OCCUPANTS WEARING
SEAT BELTS
HS-017 494
- Grover, E. C.**
LOW NOISE OPPOSED PISTON TWO-STROKE EN-
GINE AND BLOWER
HS-017 545
- Guichon, Donald M. P.**
BICYCLE INJURIES: ONE-YEAR SAMPLE IN CALGA-
RY [CANADA]
HS-017 428
- Gutshall, P. L.**
THE DEVELOPMENT OF TECHNOLOGY FOR DETEC-
TION OF MARIJUANA INTOXICATION BY ANALYSIS
OF BODY FLUIDS. FINAL REPORT
HS-801 721
- Haddon, William, Jr.**
STATEMENT BEFORE THE NATIONAL HIGHWAY
TRAFFIC SAFETY ADMINISTRATION (NHTSA) AT
THE PUBLIC MEETING ON STANDARD NO. 208, OC-
CUPANT CRASH PROTECTION, HELD MAY 19, 1975
HS-017 506

March 31, 1976

Hardenberg, Horst O.

NOISE, EMISSIONS AND PERFORMANCE OF THE DIESEL ENGINE. A COMPARISON BETWEEN DI [DIRECT INJECTION] AND IDI [INDIRECT INJECTION] COMBUSTION SYSTEMS

HS-017 529

Harrison, Ann L.

MEASURED ILLUMINATION CHARACTERISTICS OF THE 1974 HEADLAMPS. PART 1. THE S.A.E. HEADLAMPS

HS-017 555

Hawkins, G. W.

TECHNIQUES OF STRUCTURAL VIBRATION ANALYSIS APPLIED TO DIESEL ENGINE NOISE REDUCTION

HS-017 540

Hawkins, M. G.

ANALYSIS AND PREDICTION OF ENGINE STRUCTURE VIBRATION

HS-017 537

Hayes, Gordon G.

TIRE-PAVEMENT FRICTION AS A FUNCTION OF VEHICLE MANEUVERS. FINAL REPORT

HS-017 427

Hayes, H. R. M.

SERIOUS TRAUMA TO CAR OCCUPANTS WEARING SEAT BELTS

HS-017 494

Henderson, Robert L.

EFFECT OF PASSENGER LOADING ON DRIVER'S VISIBILITY [FIELD OF VIEW] FROM AUTOMOBILES

HS-801 743

Hendrickson, Robert G.

ANALYSIS OF METHODOLOGY FOR MEASURING NATIONAL HIGHWAY TRAFFIC SAFETY. FINAL REPORT

HS-801 741

Herbert, A. J.

IDENTIFICATION AND MODELING OF ROTARY FUEL INJECTION PUMP NOISE PROCESSES

HS-017 536

Hieatt, David J.

METHODS OF MEASURING DRIVER BEHAVIOUR [BEHAVIOR]

HS-017 565

Hirsch, T. J.

CRASH CUSHIONS OF WASTE MATERIALS

HS-017 430

FULL SCALE CRASH TESTS OF A TIRE-SAND INERTIA BARRIER. INTERIM REPORT

HS-017 462

Hoelzer, J. C.

EMISSION FORMATION CHARACTERISTICS OF THE DIESEL COMBUSTION PROCESS AND ESTIMATED FUTURE DEVELOPMENT TRENDS

HS-017 524

Hoppe, C.

HIGH STRENGTH MATERIALS AND VEHICLE WEIGHT REDUCTION ANALYSIS

HS-017 485

Hullender, David A.

HUMAN FACTOR AND HARDWARE DESIGN CONSIDERATIONS FOR PASSENGER PROTECTION IN HIGH SPEED CRASHES

HS-017 554

Humes, Robert W.

EFFECTS OF INTERMIXING OF BIAS, BIAS BELTED, AND RADIAL PLY PASSENGER TIRES ON VEHICLE DYNAMICS AND DRIVER/VEHICLE RESPONSES. FINAL REPORT

HS-801 702

Hunter, Harold G.

AN EVALUATION OF DRIVER SIMULATORS FOR SAFETY TRAINING

HS-017 508

Hurd, J. O.

HIGHWAY METRICATION. VOL. 1. TASKS 1, 2, 3, 4, AND APERCU. FINAL REPORT

HS-017 483

HIGHWAY METRICATION. VOL. 2. APPENDIXES. FINAL REPORT

HS-017 484

Hutchinson, T. P.

THE PERCEPTION OF VEHICLE SPEEDS BY PEDESTRIANS

HS-017 432

Janoff, Michael S.

SPECIALIZED ILLUMINATION SYSTEMS FOR PEDESTRIAN CROSSWALKS

HS-017 465

Janssen, W. H.

THE PERCEPTION OF MANOEUVRES [MANEUVERS] OF MOVING VEHICLES. PROGRESS REPORT NO. 6. IMPLICATIONS OF PSYCHOPHYSICAL THRESHOLD MEASUREMENT FOR THE NIGHT DRIVING SITUATION. FINAL REPORT

HS-017 470

Johnson, D. H.

INJURIES OCCURRING IN MOTORCYCLE ACCIDENTS

HS-017 568

Johnson, J. H.

COOPERATIVE EVALUATION OF TECHNIQUES FOR MEASURING NITRIC OXIDE AND CARBON MONOXIDE (PHASE 4 TESTS)

HS-017 443

CRC EVALUATION OF TECHNIQUES FOR MEASURING HYDROCARBONS IN DIESEL EXHAUST. PHASE 4

HS-017 442

Johnson, N.

SPILLED FUEL IGNITION SOURCES AND COUNTERMEASURES. FINAL REPORT

HS-801 722

- SAFETY VEHICLES--PROGRAM SUMMARY REPORT.**
FINAL REPORT
HS-801 717
- Jorgeson, Craig M.**
EYE FIXATIONS OF DRIVERS IN NIGHT DRIVING
WITH THREE HEADLIGHT [HEADLAMP] BEAMS.
FINAL REPORT
HS-017 547
- Kabele, D. F.**
TECHNIQUES FOR QUIETING THE DIESEL
HS-017 544
- Kamm, Irwin O.**
A CYBERNETICALLY COUPLED RESEARCH VEHICLE [CCRV]
HS-017 451
- Kane, Thomas R.**
EVALUATION OF WHEEL BLOCKING FOR VEHICLES
PARKED ON SLOPES
HS-017 511
- Kasper, A. S.**
HIGH STRENGTH MATERIALS AND VEHICLE
WEIGHT REDUCTION ANALYSIS
HS-017 485
SHEET METAL STRETCH FLANGE ANALYSIS: A
MANUFACTURING VIEWPOINT
HS-017 440
- Keisoglou, A. N.**
HIGH STRENGTH MATERIALS AND VEHICLE
WEIGHT REDUCTION ANALYSIS
HS-017 485
- Kelley, Albert B.**
STATEMENT BEFORE THE NATIONAL HIGHWAY
TRAFFIC SAFETY ADMINISTRATION (NHTSA) AT
THE PUBLIC MEETING ON STANDARD NO. 208, OC-
CUPANT CRASH PROTECTION, HELD MAY 19, 1975
HS-017 506
- Ketvirtis, A.**
VISIBILITY STUDY FOR LONG VEHICULAR TUN-
NELS
HS-017 466
- King, Barry G. , Jr.**
A SURVEY OF MOTOR VEHICLE BURN ACCIDENTS
IN CHILDREN: REPORT OF 45 CASES
HS-017 499
- King, G. F.**
RELATIONSHIP OF ACCIDENT PATTERNS TO TYPE
OF INTERSECTION CONTROL
HS-017 514
TRAFFIC SIGNAL WARRANTS. A BIBLIOGRAPHY
HS-017 492
- Klassen, Donald J.**
DRIVER PERCEPTION OF PEDESTRIAN CON-
SPICUOUSNESS UNDER STANDARD HEADLIGHT
[HEADLAMP] ILLUMINATION
HS-017 516
- Kondo, Akira**
ESTABLISHMENT AND CALIBRATION OF A TREAD
WEAR TEST COURSE
HS-017 496
- Kruse, Ronald E.**
TEST VARIABILITY OF EMISSION AND FUEL
ECONOMY MEASUREMENTS USING THE 1975
FEDERAL TEST PROCEDURE
HS-017 437
- Lalor, N.**
MODES OF ENGINE STRUCTURE VIBRATION AS A
SOURCE OF NOISE
HS-017 538
- Lam, Tenny N.**
DRIVER RESPONSE TO THE 55 MPH MAXIMUM
SPEED LIMIT AND THE VARIATIONAL CHARAC-
TERISTICS OF SPOT SPEEDS
HS-017 464
- Lamond, T. G.**
IDENTIFICATION OF ELASTOMERS IN TIRE SEC-
TIONS BY TOTAL THERMAL ANALYSIS. 2. WHITE
SIDEWALL COMPOUNDS OF EPDM AND BLENDS
HS-017 549
IDENTIFICATION OF ELASTOMERS IN TIRE SEC-
TIONS BY TOTAL THERMAL ANALYSIS. 3. WHITE
SIDEWALL COMPOUNDS OF NEOPRENE RUBBER
BLENDS
HS-017 550
IDENTIFICATION OF ELASTOMERS IN TIRE SEC-
TIONS BY TOTAL THERMAL ANALYSIS. 4. INNER-
LINER
HS-017 551
- Lane, R. S.**
TECHNIQUES OF STRUCTURAL VIBRATION ANALY-
SIS APPLIED TO DIESEL ENGINE NOISE REDUC-
TION
HS-017 540
- Laurent' yev, N.**
METHOD OF CHECKING AND ADJUSTING BRAKES
OF THE GAZ-21 ON THE BASIS OF BRAKING TIME
HS-017 455
- Lawson, Thomas E.**
REAR-IMPACTED VEHICLE COLLISIONS: FREQUEN-
CIES AND CASUALTY PATTERNS. FINAL REPORT
HS-017 461
- Le Creurer, M.**
PRACTICAL MEANS FOR REDUCING THE NOISE OF
FAST DIESEL ENGINES
HS-017 542
- Leipold, Frank W.**
NOISE, EMISSIONS AND PERFORMANCE OF THE
DIESEL ENGINE. A COMPARISON BETWEEN DI

March 31, 1976

[DIRECT INJECTION] AND IDI [INDIRECT INJECTION] COMBUSTION SYSTEMS

HS-017 529

Leisch, Jack E.

CAPACITY ANALYSIS TECHNIQUES FOR DESIGN AND OPERATION OF FREEWAY FACILITIES. FINAL REPORT

HS-017 520

Loner, Lawrence P.

COUNTERMEASURES--A COMMUNITY BASED CAMPAIGN FOR THE PREVENTION OF DRUNK DRIVING: AN EXPERIMENTAL EVALUATION

HS-017 560

Luchini, J. R.

ROLLING RESISTANCE OF PNEUMATIC TIRES. INTERIM REPORT

HS-017 519

Lyons, J. W.

CONSIDERATIONS IN THE USE OF SAMPLING PLANS FOR EFFECTING COMPLIANCE WITH MANDATORY SAFETY STANDARDS. FINAL REPORT

HS-017 426

Macaulay, T.

ACCIDENT AVOIDANCE TEST REPORT--NISSAN AND TOYOTA EXPERIMENTAL SAFETY VEHICLES. FINAL TEST REPORT

HS-801 713

MacKay, G. M.

SERIOUS TRAUMA TO CAR OCCUPANTS WEARING SEAT BELTS

HS-017 494

Marmolin, Hans

INTERINDIVIDUAL DIFFERENCES IN MESOPIC NIGHT VISION ABILITY MEASURED BY THE MESOPTOMETER

HS-017 481

Marquis, E. L.

CRASH CUSHIONS OF WASTE MATERIALS

HS-017 430

FULL SCALE CRASH TESTS OF A TIRE-SAND INERTIA BARRIER. INTERIM REPORT

HS-017 462

Marsh, J. C., 4th

MULTIDISCIPLINARY ACCIDENT INVESTIGATION DATA FILE, 1974. FINAL REPORT

HS-801 733

Marty, M.

PRACTICAL MEANS FOR REDUCING THE NOISE OF FAST DIESEL ENGINES

HS-017 542

McFadden, J. J.

A LIGHT DUTY DIESEL FOR AMERICA?

HS-017 487

McGee, H. W.

RIGHT-TURN-ON-RED: CURRENT PRACTICES AND STATE-OF-THE-ART. INTERIM REPORT

HS-017 503

McKnight, A. James

AN EVALUATION OF DRIVER SIMULATORS FOR SAFETY TRAINING

HS-017 508

McVinnie, W. W.

HIGH STRENGTH MATERIALS AND VEHICLE WEIGHT REDUCTION ANALYSIS

HS-017 485

Meacham, D. G.

HIGHWAY METRICATION. VOL. 1. TASKS 1, 2, 3, 4, AND APERCU. FINAL REPORT

HS-017 483

HIGHWAY METRICATION. VOL. 2. APPENDIXES. FINAL REPORT

HS-017 484

Miller, William K.

EVALUATING THE EFFECTS OF CORROSION ON STRUCTURAL MATERIALS. A STUDY OF PLAIN CARBON AND HIGH STRENGTH LOW ALLOY STEELS

HS-017 453

Minahan, Daniel J.

EFFECTS OF THE ENERGY CRISIS AND 55 MPH SPEED LIMIT IN MICHIGAN. FINAL REPORT

HS-017 463

Mitchell, M. R.

EFFECTS OF GRAPHITE MORPHOLOGY, MATRIX HARDNESS, AND STRUCTURE ON THE FATIGUE RESISTANCE OF GRAY CAST IRON

HS-017 441

Mitric, S.

HIGHWAY METRICATION. VOL. 1. TASKS 1, 2, 3, 4, AND APERCU. FINAL REPORT

HS-017 483

HIGHWAY METRICATION. VOL. 2. APPENDIXES. FINAL REPORT

HS-017 484

Monaghan, M. L.

A LIGHT DUTY DIESEL FOR AMERICA?

HS-017 487

Mortimer, Rudolf G.

EYE FIXATIONS OF DRIVERS IN NIGHT DRIVING WITH THREE HEADLIGHT [HEADLAMP] BEAMS. FINAL REPORT

HS-017 547

Mortimer, Rudolph G.

EXPERIMENTAL AND COMPUTER SIMULATION EVALUATION OF HEADLAMP BEAMS

HS-017 457

Muehlhause, C. O.

CONSIDERATIONS IN THE USE OF SAMPLING PLANS FOR EFFECTING COMPLIANCE WITH MANDATORY SAFETY STANDARDS. FINAL REPORT

HS-017 426

Munro, R.

TRANSVERSE MOVEMENT ANALYSIS AND ITS INFLUENCE ON DIESEL PISTON DESIGN

HS-017 533

- Munro, Stuart**
MOTORCYCLE TRAINING--STANDARDS FOR SURVIVAL
HS-017 570
- Myles, S. Terence**
BICYCLE INJURIES: ONE-YEAR SAMPLE IN CALGARY [CANADA]
HS-017 428
- Natrella, M. G.**
CONSIDERATIONS IN THE USE OF SAMPLING PLANS FOR EFFECTING COMPLIANCE WITH MANDATORY SAFETY STANDARDS. FINAL REPORT
HS-017 426
- Newhall, H. K.**
COMBUSTION PROCESS FUNDAMENTALS AND COMBUSTION CHAMBER DESIGN FOR LOW EMISSIONS
HS-017 523
- Newman, James A.**
THE PROTECTIVE VALUE OF CONTEMPORARY MOTORCYCLE HELMETS IN THE PREVENTION OF HEAD INJURIES
HS-017 569
- Nickel, G. H.**
THERMOANALYTICAL METHODS IN VULCANIZATE ANALYSIS. 2. DERIVATIVE THERMOGRAVIMETRIC ANALYSIS
HS-017 552
- O'Brien, W. J.**
TEMPERATURE MEASUREMENT FOR GAS TURBINE ENGINES
HS-017 446
- O'Day, James**
EFFECTS OF THE ENERGY CRISIS AND 55 MPH SPEED LIMIT IN MICHIGAN. FINAL REPORT
HS-017 463
REAR-IMPACTED VEHICLE COLLISIONS: FREQUENCIES AND CASUALTY PATTERNS. FINAL REPORT
HS-017 461
- Ochiai, Kazuomi**
SIMPLE MODEL TECHNIQUE FOR BETTER UNDERSTANDING OF DIESEL ENGINE VIBRATION AND NOISE
HS-017 539
- Ovenshire, L.**
THORACIC IMPACT INJURY MECHANISM. VOL. 1. FINAL REPORT
HS-801 710
THORACIC IMPACT INJURY MECHANISM. VOL. 2. [APPENDICES.] FINAL REPORT
HS-801 711
- Parker, A.**
TRANSVERSE MOVEMENT ANALYSIS AND ITS INFLUENCE ON DIESEL PISTON DESIGN
HS-017 533
- Paulsell, C. Don**
TEST VARIABILITY OF EMISSION AND FUEL ECONOMY MEASUREMENTS USING THE 1975 FEDERAL TEST PROCEDURE
HS-017 437
- Peltzman, Sam**
THE EFFECTS OF AUTOMOBILE SAFETY REGULATION
HS-017 477
- Perez, J. M.**
COOPERATIVE EVALUATION OF TECHNIQUES FOR MEASURING NITRIC OXIDE AND CARBON MONOXIDE (PHASE 4 TESTS)
HS-017 443
- Perfater, Michael A.**
ASSESSMENT OF PEDESTRIAN ATTITUDES AND BEHAVIOR IN SUBURBAN ENVIRONMENTS
HS-017 517
- Perry, J. W.**
TRAFFIC SIGNAL WARRANTS. A BIBLIOGRAPHY
HS-017 492
- Petyt, M.**
MODES OF ENGINE STRUCTURE VIBRATION AS A SOURCE OF NOISE
HS-017 538
- Pierce, R. N.**
UNIFORM TIRE QUALITY GRADING--TREADWEAR. CITY TEST. FINAL REPORT
HS-801 735
- Porkess, A. M.**
NOISE--THE DIESEL ENGINE DESIGNERS' DILEMMA
HS-017 546
- Potter, Tom E.**
THREE-DIMENSIONAL HUMAN DISPLAY MODEL
HS-017 556
- Potts, G. R.**
TIRE VIBRATION STUDIES: THE STATE OF THE ART
HS-017 498
- Preston, Fred**
INTERACTIONS OF OCCUPANT AGE, VEHICLE WEIGHT, AND THE PROBABILITY OF DYING IN A TWO-VEHICLE CRASH
HS-017 472
- Priede, T.**
THE PROBLEMS OF NOISE OF ENGINES IN DIFFERENT VEHICLE GROUPS
HS-017 528
- Pullen, H. L.**
LOW NOISE OPPOSED PISTON TWO-STROKE ENGINE AND BLOWER
HS-017 545
- Radwan, M. S.**
HIGHLY TURBOCHARGED SMALL AUTOMOTIVE DIESEL ENGINES
HS-017 580

- Katz, J. C.**
EVALUATION OF GLARE REDUCTION
TECHNIQUES. FINAL REPORT
HS-801 718
- Rattenbury, S. J.**
SERIOUS TRAUMA TO CAR OCCUPANTS WEARING
SEAT BELTS
HS-017 494
- Reason, James**
STYLE, PERSONALITY AND ACCIDENTS
HS-017 500
- Reddi, M. M.**
THORACIC IMPACT INJURY MECHANISM. VOL. 1.
FINAL REPORT
HS-801 710
THORACIC IMPACT INJURY MECHANISM. VOL. 2.
[APPENDICIES.] FINAL REPORT
HS-801 711
- Rendahl, Ilmari**
INTERINDIVIDUAL DIFFERENCES IN MESOPIC
NIGHT VISION ABILITY MEASURED BY THE
MESOPTOMETER
HS-017 481
- Rice, R. J.**
NOISE--THE DIESEL ENGINE DESIGNERS' DILEM-
MA
HS-017 546
- Roberts, Robert R.**
EFFECT OF 55-MPH SPEED LIMIT ON AVERAGE
SPEEDS OF FREE-FLOWING AUTOMOBILES ON AN
INTERSTATE BRIDGE IN WEST VIRGINIA
HS-017 575
- Robertson, H. Locke**
QUALITY MEASUREMENT OF EMERGENCY MEDI-
CAL CARE
HS-017 572
- Robertson, Leon S.**
RESTRAINT USE AND EFFECTIVENESS IN REAL-
WORLD CRASHES; FEW CHILDREN PROTECTED IN
CARS; [AND] PAPERS RELEVANT TO FEDERAL
MOTOR VEHICLE SAFETY
HS-017 507
- Rodgers, Colin**
PERFORMANCE AND APPLICATION OF THE EX-
DUCER POWER TURBINE
HS-017 447
- Rodgers, V. A.**
THORACIC IMPACT INJURY MECHANISM. VOL. 2.
[APPENDICIES.] FINAL REPORT
HS-801 711
- Rogers, V. A.**
THORACIC IMPACT INJURY MECHANISM. VOL. 1.
FINAL REPORT
HS-801 710
- Rohrle, Manfred D.**
AFFECTING DIESEL ENGINE NOISE BY THE PISTON
HS-017 532
- Kony, David A.**
TEMPERATURE MEASUREMENT FOR ADVANCED
GAS TURBINE CONTROLS
HS-017 445
- Rosenbaum, Merton J.**
SPEED CONTROL IN RURAL SCHOOL ZONES
HS-017 577
- Rosenblatt, J. R.**
CONSIDERATIONS IN THE USE OF SAMPLING
PLANS FOR EFFECTING COMPLIANCE WITH MAN-
DATORY SAFETY STANDARDS. FINAL REPORT
HS-017 426
- Ross, James W., Jr.**
CONCEPTS IN SAFETY BELT TESTING. FINAL RE-
PORT
HS-017 553
- Russell, M. F.**
IDENTIFICATION AND MODELING OF ROTARY
FUEL INJECTION PUMP NOISE PROCESSES
HS-017 536
- Sakata, Seiji**
SIMPLE MODEL TECHNIQUE FOR BETTER UN-
DERSTANDING OF DIESEL ENGINE VIBRATION
AND NOISE
HS-017 539
- Sanderson, J. E.**
DRIVER RECALL OF ROADSIDE SIGNS
HS-017 456
- Sanderson, S.**
SPILLED FUEL IGNITION SOURCES AND COUNTER-
MEASURES. FINAL REPORT
HS-801 722
- Schurr,**
EVALUATING THE EFFECTIVENESS OF REEDUCA-
TION PROGRAMS FOR CONVICTED [ALCOHOL] IM-
PAIRED DRIVERS
HS-017 451
- Scott, W. M.**
THE LIGHT DUTY DIESEL ENGINE FOR PRIVATE
TRANSPORTATION
HS-017 488
- Semonin, E. V.**
MOTION RESISTANCE OF PNEUMATIC TYRES
[TIRES]
HS-017 581
- Sewell, R. T.**
ANALYSIS OF DRIVER CONTROL MOVEMENTS ON
A LIMITED-ACCESS DIVIDED HIGHWAY
HS-017 489
- Shanley, John W.**
SAFETY IN MASS TRANSIT: A CASE STUDY OF BUS
ACCIDENTS IN WASHINGTON, D.C.
HS-017 504
- Shelness, Annemarie**
CHILDREN AS PASSENGERS IN AUTOMOBILES: THE
NEGLECTED MINORITY ON THE NATION'S
HIGHWAYS
HS-017 493

Shoemaker, Robert H.ADVANCES IN LOW TEMPERATURE LIQUID NITRID-
ING

HS-017 438

Siler, Kenneth F.METHODOLOGIES FOR THE EVALUATION AND IM-
PROVEMENT OF EMERGENCY MEDICAL SERVICE
SYSTEMS. VOL. 2. APPENDICES. FINAL REPORT

HS-801 704

Siman, Alfred W.REDUCING THE TRANSMITTED VIBRATIONS FROM
SINGLE CYLINDER ENGINES

HS-017 525

Sircar, A. K.IDENTIFICATION OF ELASTOMERS IN TIRE SEC-
TIONS BY TOTAL THERMAL ANALYSIS. 2. WHITE
SIDEWALL COMPOUNDS OF EPDM AND BLENDS

HS-017 549

IDENTIFICATION OF ELASTOMERS IN TIRE SEC-
TIONS BY TOTAL THERMAL ANALYSIS. 3. WHITE
SIDEWALL COMPOUNDS OF NEOPRENE RUBBER
BLENDS

HS-017 550

IDENTIFICATION OF ELASTOMERS IN TIRE SEC-
TIONS BY TOTAL THERMAL ANALYSIS. 4. INNER-
LINER

HS-017 551

Sjukkhuset, KarolinskaINTERINDIVIDUAL DIFFERENCES IN MESOPIC
NIGHT VISION ABILITY MEASURED BY THE
MESOPTOMETER

HS-017 481

Smith, M. E.HIGHWAY METRICATION. VOL. 1. TASKS 1, 2, 3, 4,
AND APERCU. FINAL REPORT

HS-017 483

HIGHWAY METRICATION. VOL. 2. APPENDIXES.
FINAL REPORT

HS-017 484

Soliday, Stanley M.DESIGN AND IMPLEMENTATION OF A SYSTEM TO
RECORD DRIVER LATERAL POSITIONING

HS-017 574

Sonoda, ShigeruPISTON SLAP NOISE OF INDIRECT COMBUSTION
DIESEL ENGINE

HS-017 534

Southall, R.ANALYSIS AND PREDICTION OF ENGINE STRUC-
TURE VIBRATION

HS-017 537

Springer, Karl J.

DIESEL EMISSION CONTROL THROUGH RETROFITS

HS-017 444

EMISSIONS AND ECONOMY OF FOUR DIESEL CARS

HS-017 582

Stahman, Ralph C.

DIESEL EMISSION CONTROL THROUGH RETROFITS

EMISSIONS AND ECONOMY OF FOUR DIESEL CARS

HS-017 582

Stiehler, R. D.CONSIDERATIONS IN THE USE OF SAMPLING
PLANS FOR EFFECTING COMPLIANCE WITH MAN-
DATORY SAFETY STANDARDS. FINAL REPORT

HS-017 426

Swart, BernieTHE STRUGGLE OVER WHAT'S UP FRONT [THE AR-
GUMENT ABOUT FRONT AXLE WEIGHT MAXIMUM]

HS-017 576

Taylor, Dean L.EVALUATION OF WHEEL BLOCKING FOR VEHI-
CLES PARKED ON SLOPES

HS-017 511

Taylor, M. J.

THE SEAT BELT ARGUMENT

HS-017 566

Tee, N. D. C.HIGHLY TURBOCHARGED SMALL AUTOMOTIVE
DIESEL ENGINES

HS-017 580

Thackray, Richard M., Jr.SURVEY OF SAFETY RELATED CONDITIONS IN
SCHOOL BUSES. FINAL REPORT

HS-801 659

Thein, Gerhard E.DESIGN CONCEPTS OF DIESEL ENGINES WITH LOW
NOISE EMISSION

HS-017 543

Tichauer, Erwin R.DELAYED EFFECTS OF ACUTE ALCOHOLIC INTOXI-
CATION ON PERFORMANCE WITH REFERENCE TO
WORK SAFETY

HS-017 510

Timour, S. E.TECHNIQUES OF STRUCTURAL VIBRATION ANALY-
SIS APPLIED TO DIESEL ENGINE NOISE REDUC-
TION

HS-017 540

Tipler, W.ENERGY ECONOMICS OF AUTOMOTIVE POWER
GENERATION

HS-017 513

Tofany, Vincent L.FACTORS CONTRIBUTING TO THE REDUCTION OF
MOTOR VEHICLE FATALITIES IN 1974

HS-017 509

Tryhorn, D. W.LOW NOISE OPPOSED PISTON TWO-STROKE EN-
GINE AND BLOWER

HS-017 545

Tsai, H. C.THORACIC IMPACT INJURY MECHANISM. VOL. 1.
FINAL REPORT

HS-801 710

March 31, 1976

- THORACIC IMPACT INJURY MECHANISM. VOL. 2.
[APPENDICIES.] FINAL REPORT
HS-001 711
- Turkish, Michael C.**
PRECHAMBER AND VALVE GEAR DESIGN FOR 3-
VALVE STRATIFIED CHARGE ENGINES
HS-017 526
- Ungers, R.**
THE INTRODUCTION OF COMPULSORY SEAT BELT
WEARING LAWS IN AUSTRALIA AND THEIR EF-
FECT
HS-017 567
- Usami, Takashi**
PISTON SLAP NOISE OF INDIRECT COMBUSTION
DIESEL ENGINE
HS-017 534
- Valentine, J. L.**
THE DEVELOPMENT OF TECHNOLOGY FOR DETEC-
TION OF MARIJUANA INTOXICATION BY ANALYSIS
OF BODY FLUIDS. FINAL REPORT
HS-001 721
- Vanstrum, Robert C.**
DRIVER PERCEPTION OF PEDESTRIAN CON-
SPICUOUSNESS UNDER STANDARD HEADLIGHT
[HEADLAMP] ILLUMINATION
HS-017 516
- Vaughan, Rodney G.**
REFLECTORISED NUMBER (LICENCE) PLATES
[REFLECTORIZED LICENSE PLATES] AND TRAFFIC
SAFETY IN AUSTRALIA
HS-017 518
- Vieg, Karsten J.**
STATEMENT OF THE STATE OF ILLINOIS IN
RESPONSE TO THE HIGHWAY SAFETY SANCTION
HEARING, WASHINGTON, D.C., SEPTEMBER 30, 1975
HS-017 502
- Wada, Shinji**
PISTON SLAP NOISE OF INDIRECT COMBUSTION
DIESEL ENGINE
HS-017 534
- Wagner, T. O.**
CRC EVALUATION OF TECHNIQUES FOR MEASUR-
ING HYDROCARBONS IN DIESEL EXHAUST. PHASE
4
HS-017 442
- Ward, Michael E.**
PRACTICAL APPLICATION OF FORWARD EXTRU-
SION THEORY
HS-017 439
- Warner, Donald R.**
THREE GENERATIONS OF SOVIET WHEELED MILI-
TARY TRANSPORT VEHICLES
HS-017 452
- Wasielewski, Paul**
DRIVER RESPONSE TO THE 55 MPH MAXIMUM
SPEED LIMIT AND THE VARIATIONAL CHARAC-
TERISTICS OF SPOT SPEEDS
HS-017 464
- Weeks, W. L.**
SHEET METAL STRETCH FLANGE ANALYSIS: A
MANUFACTURING VIEWPOINT
HS-017 440
- Wendt, F. W.**
THORACIC IMPACT INJURY MECHANISM. VOL. 1.
FINAL REPORT
HS-001 710
- THORACIC IMPACT INJURY MECHANISM. VOL. 2.
[APPENDICIES.] FINAL REPORT
HS-001 711
- Wheelock, Wayne K.**
THE EFFECT OF AUTOMATIC TRANSMISSIONS ON
MILITARY TRUCK FUEL ECONOMY
HS-017 450
- Whitehead, Paul C.**
DWI PROGRAMS: DOING WHAT'S IN OR DODGING
WHAT'S INDICATED?
HS-017 512
- Wilkins, Leslie O.**
HUMAN FACTOR AND HARDWARE DESIGN CON-
SIDERATIONS FOR PASSENGER PROTECTION IN
HIGH SPEED CRASHES
HS-017 554
- Williamson, Glen A.**
DESIGN AND IMPLEMENTATION OF A SYSTEM TO
RECORD DRIVER LATERAL POSITIONING
HS-017 574
- Willmert, Kenneth D.**
OCCUPANT MODEL FOR HUMAN MOTION
HS-017 434
- THREE-DIMENSIONAL HUMAN DISPLAY MODEL
HS-017 556
- Winger, J. H.**
CONSIDERATIONS IN THE USE OF SAMPLING
PLANS FOR EFFECTING COMPLIANCE WITH MAN-
DATORY SAFETY STANDARDS. FINAL REPORT
HS-017 426
- Wolkenberg, Robert C.**
DELAYED EFFECTS OF ACUTE ALCOHOLIC INTOXI-
CATION ON PERFORMANCE WITH REFERENCE TO
WORK SAFETY
HS-017 510
- Wood, Rosamond**
REFLECTORISED NUMBER (LICENCE) PLATES
[REFLECTORIZED LICENSE PLATES] AND TRAFFIC
SAFETY IN AUSTRALIA
HS-017 518
- Wormley, David N.**
THE DEVELOPMENT AND COMPARATIVE EVALUA-
TION OF ANALYTICAL TIRE MODELS FOR DYNAM-
IC VEHICLE SIMULATION. FINAL REPORT
HS-017 548
- Wright, C. C.**
THE PERCEPTION OF VEHICLE SPEEDS BY
PEDESTRIANS
HS-017 432

Yorke, P. J.

THE APPLICATION OF IDEALIZATION AND
RESPONSE ANALYSIS TO DIESEL ENGINE NOISE
ASSESSMENT

HS-017 541

Young, Phyllis

SPEED CONTROL IN RURAL SCHOOL ZONES

HS-017 577

Zelhart,

EVALUATING THE EFFECTIVENESS OF REEDUCA-

TION PROGRAMS FOR CONVICTED [ALCOHOL] I
PAIRED DRIVERS

HS-017

Zimmermann, Klaus D.

INJECTION NOISE AND ITS RELATION TO FU
PUMP AND ENGINE NOISE

HS-017

Zylman, Richard

COMMENTS ON ALCOHOL INVOLVEMENT
FATAL AND NON-FATAL CRASHES

HS-017

Corporate Author Index

A. E. Developments Ltd., England

TRANSVERSE MOVEMENT ANALYSIS AND ITS INFLUENCE ON DIESEL PISTON DESIGN

HS-017 533

Air Force Office of the Surgeon General, Washington, D.C.

AN EVALUATION METHODOLOGY FOR EMERGENCY MEDICAL SERVICES

HS-017 571

Alan M. Voorhees and Associates, Inc., Westgate Res.

Park, McLean, Va. 22101

RIGHT-TURN-ON-RED: CURRENT PRACTICES AND STATE-OF-THE-ART. INTERIM REPORT

HS-017 503

Allstate Insurance Co.

DE LOREAN REPORT TO FEDERAL ENERGY ADMINISTRATION SAYS FUEL SAVING CARS NEED AIR BAGS [NEWS RELEASE]

HS-017 474

American Assoc. of Community and Junior Colleges,

One Dupont Circle, N.W., Washington, D.C. 20036

COMMERCIAL DRIVING SCHOOL INSTRUCTOR: PROJECT AT OHLONE COLLEGE. FINAL REPORT

HS-801 746

American Assoc. of State Hwy. and Transportation

Officials, 341 National Press Bldg., Washington, D.C.

20045

EFFECTS OF THE 55 MPH SPEED LIMIT

HS-017 454

American Oil Co.

CRC EVALUATION OF TECHNIQUES FOR MEASURING HYDROCARBONS IN DIESEL EXHAUST. PHASE 4

HS-017 442

Applied Science Assocs., Inc., Box 158, Valencia, Pa.

16059

SURVEY OF SAFETY RELATED CONDITIONS IN SCHOOL BUSES. FINAL REPORT

HS-801 659

Army Tank-Auto. Command

A CYBERNETICALLY COUPLED RESEARCH VEHICLE [CCRV]

HS-017 451

THE EFFECT OF AUTOMATIC TRANSMISSIONS ON MILITARY TRUCK FUEL ECONOMY

HS-017 450

Australian Dept. of Transport, Road Safety Res. Sec.

THE INTRODUCTION OF COMPULSORY SEAT BELT WEARING LAWS IN AUSTRALIA AND THEIR EFFECT

HS-017 567

Automobiles Peugeot, France

PRACTICAL MEANS FOR REDUCING THE NOISE OF FAST DIESEL ENGINES

HS-017 542

AVL, Austria

DESIGN CONCEPTS OF DIESEL ENGINES WITH LOW NOISE EMISSION

HS-017 543

British Leyland, Ltd., Truck and Bus Div., England

NOISE--THE DIESEL ENGINE DESIGNERS' DILEMMA

HS-017 546

California Dept. of Motor Vehicles, Div. of Field Office Operation

MOTORCYCLE TRAINING FOR CALIFORNIA DRIVER LICENSING PERSONNEL. FINAL REPORT

HS-017 459

California Hwy. Patrol, Sacramento, Calif.

ACCIDENT CHANGES UNDER ENERGY CRISIS. REPORT ON ACCIDENT REDUCTION VARIABLES

HS-017 480

Calspan Corp., Buffalo, N. Y. 14221

RESEARCH SAFETY VEHICLE (RSV). PHASE 2. STATUS REPORT NO. 1

HS-801 730

Calspan Corp., Buffalo, N.Y. 14221

ADVANCED PASSIVE RESTRAINT SYSTEM FOR SUB-COMPACT SIZE VEHICLE FRONT SEAT PASSENGERS. PROGRESS REPORTS 14 AND 15, 4 AUGUST 1975 TO 5 OCTOBER 1975

HS-801 752

OCCUPANT SURVIVABILITY IN LATERAL COLLISIONS. PROGRESS REPORTS 7-13, 1 FEBRUARY 1975 TO 31 AUGUST 1975

HS-801 751

Canada Ministry of Transport

TRAFFIC SAFETY. PROCEEDINGS OF THE SCIENTIFIC CONFERENCE, OTTAWA, ONTARIO, CANADA, MAY 23 AND 24, 1974

HS-017 559

Canadian Dept. of National Health and Welfare

TRAFFIC SAFETY. PROCEEDINGS OF THE SCIENTIFIC CONFERENCE, OTTAWA, ONTARIO, CANADA, MAY 23 AND 24, 1974

HS-017 559

Caterpillar Tractor Co.

COOPERATIVE EVALUATION OF TECHNIQUES FOR MEASURING NITRIC OXIDE AND CARBON MONOXIDE (PHASE 4 TESTS)

HS-017 443

Cay Ltd., England

IDENTIFICATION AND MODELING OF ROTARY FUEL INJECTION PUMP NOISE PROCESSES

HS-017 536

Chrysler Corp.

DEVELOPMENT OF LIGHTWEIGHT DOOR INTRUSION BEAMS UTILIZING AN ULTRA HIGH STRENGTH STEEL

HS-017 486

SHEET METAL STRETCH FLANGE ANALYSIS: A
MANUFACTURING VIEWPOINT

HS-017 440

Chrysler Corp., Engineering Office
HIGH STRENGTH MATERIALS AND VEHICLE
WEIGHT REDUCTION ANALYSIS

HS-017 485

PRACTICAL APPLICATION OF FORWARD EXTRU-
SION THEORY

HS-017 439

**City of Reading, USAC Proj., P. O. Box 7, Reading, Pa.
19603**

USER MANUAL FOR THE TRAFFIC ACCIDENT
RECORDING MODULE

HS-017 435

Clarkson Coll. of Tech., Potsdam, N.Y. 13676

THREE-DIMENSIONAL HUMAN DISPLAY MODEL

HS-017 556

**Clarkson Coll. of Technology, Dept. of Mechanical and
Industrial Engineering, Potsdam, N. Y. 13676**

OCCUPANT MODEL FOR HUMAN MOTION

HS-017 434

**Colorado State Dept. of Hwys., Staff Traffic and Traffic
Safety Div.**

A STUDY OF THE EFFECTS OF THE 55-MPH SPEED
LIMIT

HS-017 469

**Consortium of Universities, 1717 Massachusetts Ave.,
N.W., Washington, D.C. 20036**

SAFETY IN MASS TRANSIT: A CASE STUDY OF BUS
ACCIDENTS IN WASHINGTON, D.C.

HS-017 504

Cummins Engine Co.

COOPERATIVE EVALUATION OF TECHNIQUES FOR
MEASURING NITRIC OXIDE AND CARBON MONOX-
IDE (PHASE 4 TESTS)

HS-017 443

Cummins Engine Co., Inc.

CRC EVALUATION OF TECHNIQUES FOR MEASUR-
ING HYDROCARBONS IN DIESEL EXHAUST. PHASE
4

HS-017 442

TECHNIQUES OF STRUCTURAL VIBRATION ANALY-
SIS APPLIED TO DIESEL ENGINE NOISE REDUC-
TION

HS-017 540

Daimler-Benz, AG, West Germany

NOISE, EMISSIONS AND PERFORMANCE OF THE
DIESEL ENGINE. A COMPARISON BETWEEN DI
[DIRECT INJECTION] AND IDI [INDIRECT INJEC-
TION] COMBUSTION SYSTEMS

HS-017 529

Department of Motor Transport, Traffic Accident Res.

Unit, Box 28, G.P.O., Sydney, N.S.W., Australia 2001
REFLECTORISED NUMBER (LICENCE) PLATES
[REFLECTORIZED LICENSE PLATES] AND TRAFFIC
SAFETY IN AUSTRALIA

HS-017 518

**Department of National Health and Welfare, Ottawa
Ont., Canada**

DRUGS (OTHER THAN ALCOHOL) AND DRIVING
HS-4

**Department of Transport, Bureau of Transport
Economics, Canberra, Australia**
ELECTRIC CARS

HS-4

**Department of Transportation, Office of the Secretary
THE TRANSPORTATION INDUSTRY CONFERENCE
ON INFLATION, LOS ANGELES, CALIFORNIA
SEPTEMBER 19-20, 1974**

HS-4

**Dunlap and Assocs., Inc., One Parkland Drive, Dan-
Conn. 06820**

ALCOHOL, HIGHWAY SAFETY AND THE
DEFENSE ATTORNEY. FINAL TECHNICAL REPORT

HS-4

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Conn. 06820**

POLICE MANAGEMENT TRAINING. FACTORS
INFLUENCING DWI ARRESTS. FINAL TECHNICAL
REPORT

HS-4

Eaton Corp.

PRECHAMBER AND VALVE GEAR DESIGN FOR
VALVE STRATIFIED CHARGE ENGINES

HS-4

Environmental Protection Agency

A LIGHT DUTY DIESEL FOR AMERICA?

HS-4

DIESEL EMISSION CONTROL THROUGH RETROFIT
HS-4

EMISSIONS AND ECONOMY OF FOUR DIESEL
HS-4

TEST VARIABILITY OF EMISSION AND
ECONOMY MEASUREMENTS USING THE
FEDERAL TEST PROCEDURE

HS-4

**Environmental Protection Agency, Office of Noise
Abatement and Control, 1921 Jefferson Davis Hwy
Crystal Mall 2, Arlington, Va. 20460**

PASSENGER NOISE ENVIRONMENTS OF ENCLOSED
TRANSPORTATION SYSTEMS

HS-4

**Federal Aviation Administration, Flight Standards
Technical Div., Oklahoma City, Okla. 73125**

CONCEPTS IN SAFETY BELT TESTING. FINAL
REPORT

HS-4

**Federal Hwy. Administration, Bureau of Motor Car
Safety, Washington, D.C. 20590**

MOTOR CARRIER ACCIDENT INVESTIGATION
WARE OIL AND SUPPLY CO., INC. ACCIDENT
MARCH 1, 1975--PERRY, FLORIDA

HS-4

**Florida Dept. of Hwy. Safety and Motor Vehicles,
Accident Records Sec.**

TRAFFIC ACCIDENT FACTS, 1974 [FLORIDA]. AN ILLUSTRATED ANALYSIS OF ACCIDENT RECORDS
HS-017 473

**Foster-Miller Assocs., Inc., 135 Second Ave., Waltham,
Mass. 02154**

THE DEVELOPMENT AND COMPARATIVE EVALUATION OF ANALYTICAL TIRE MODELS FOR DYNAMIC VEHICLE SIMULATION. FINAL REPORT
HS-017 548

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Philadelphia, Pa. 19103**

THORACIC IMPACT INJURY MECHANISM. VOL. 1. FINAL REPORT
HS-801 710

THORACIC IMPACT INJURY MECHANISM. VOL. 2. [APPENDICES.] FINAL REPORT
HS-801 711

**General Motors Corp., Detroit Diesel Allison Div.
TEMPERATURE MEASUREMENT FOR GAS TURBINE
ENGINES**

HS-017 446

General Motors Corp., Res. Labs.

EVALUATING THE EFFECTS OF CORROSION ON STRUCTURAL MATERIALS. A STUDY OF PLAIN CARBON AND HIGH STRENGTH LOW ALLOY STEELS
HS-017 453

**General Motors Corp., Res. Labs., Warren, Mich.
DRIVER RESPONSE TO THE 55 MPH MAXIMUM
SPEED LIMIT AND THE VARIATIONAL CHARACTERISTICS OF SPOT SPEEDS**

HS-017 464

**George Washington Univ., Human Resources Res.
Organization (HumRRO), 300 North Washington St.,
Alexandria, Va. 22314**

AN EVALUATION OF DRIVER SIMULATORS FOR SAFETY TRAINING
HS-017 508

**Highway Safety Res. Inst., Huron Pkwy. and Baxter Rd.,
Ann Arbor, Mich. 48105**

MULTIDISCIPLINARY ACCIDENT INVESTIGATION DATA FILE, 1974. FINAL REPORT
HS-801 733

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Safety**

STATEMENT OF THE STATE OF ILLINOIS IN RESPONSE TO THE HIGHWAY SAFETY SANCTION HEARING, WASHINGTON, D.C., SEPTEMBER 30, 1975
HS-017 502

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Subcommittee**

ROADWAY SIGN ILLUMINATION
HS-017 468

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DEVELOPMENT OF LIGHTWEIGHT DOOR INTRUSION BEAMS UTILIZING AN ULTRA HIGH STRENGTH STEEL
HS-017 486

**Institution for Road Safety Res. SWOV, P.O. Box 71,
Deernstraat 1, Voorburg 2119, The Netherlands
CRASH HELMETS FOR MOPED RIDERS**

HS-017 431

Insurance Inst. for Hwy. Safety

STATEMENT BEFORE THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA) AT THE PUBLIC MEETING ON STANDARD NO. 208, OCCUPANT CRASH PROTECTION, HELD MAY 19, 1975
HS-017 506

Insurance Inst. for Hwy. Safety, Washington, D.C.

RESTRAINT USE AND EFFECTIVENESS IN REAL-WORLD CRASHES; FEW CHILDREN PROTECTED IN CARS; [AND] PAPERS RELEVANT TO FEDERAL MOTOR VEHICLE SAFETY
HS-017 507

**International Assoc. of Chiefs of Police, Inc., Hwy.
Safety Div.**

MODEL POLICE TRAFFIC SERVICES, POLICIES, PROCEDURES, RULES, AND REGULATIONS. MANUAL. PHASE 2. MODEL POLICE TRAFFIC SERVICES PROCEDURES
HS-801 734

International Harvester Co., Solar Div.

PERFORMANCE AND APPLICATION OF THE EX-DUCER POWER TURBINE
HS-017 447

**International Harvester Co., Solar Div. San Diego, Calif.
TEMPERATURE MEASUREMENT FOR ADVANCED
GAS TURBINE CONTROLS**

HS-017 445

Isuzu Motors, Ltd., Japan

SIMPLE MODEL TECHNIQUE FOR BETTER UNDERSTANDING OF DIESEL ENGINE VIBRATION AND NOISE
HS-017 539

J. I. Case Co.

EMISSION FORMATION CHARACTERISTICS OF THE DIESEL COMBUSTION PROCESS AND ESTIMATED FUTURE DEVELOPMENT TRENDS
HS-017 524

**Jack E. Leisch and Assoc., State National Bank Plaza,
1603 Orrington, Suite 1290, Evanston, Ill. 60201**

CAPACITY ANALYSIS TECHNIQUES FOR DESIGN AND OPERATION OF FREEWAY FACILITIES. FINAL REPORT
HS-017 520

John Deere Waterloo Tractor Works

TECHNIQUES FOR QUIETING THE DIESEL
HS-017 544

- John Z. De Lorean Corp., Bloomfield Hills, Mich.**
AUTOMOTIVE OCCUPANT PROTECTIVE SAFETY AIR
CUSHION %AIR BAG% EXPENDITURE/BENEFIT
STUDY [APPENDIX I. COMPUTER RUN SUMMARY]
HS-017 475
- AUTOMOTIVE OCCUPANT PROTECTIVE SAFETY AIR
CUSHION [AIR BAG] EXPENDITURE/BENEFIT
STUDY
HS-017 476
- Kappa Systems, Inc., 1501 Wilson Blvd., Arlington, Va. 22209**
STANDARDS ENFORCEMENT TEST REPORTS INDEX
FOR 1973
HS-801 663
- Kolene Corp.**
ADVANCES IN LOW TEMPERATURE LIQUID NITRID-
ING
HS-017 438
- Mahle, GmbH, West Germany**
AFFECTING DIESEL ENGINE NOISE BY THE PISTON
HS-017 532
- Massachusetts Inst. of Tech.**
TECHNIQUES OF STRUCTURAL VIBRATION ANALY-
SIS APPLIED TO DIESEL ENGINE NOISE REDUC-
TION
HS-017 540
- Mechanical Technology Inc.**
EARLY DETECTION OF DEFECTS IN ROLLING-ELE-
MENT BEARINGS
HS-017 448
- Michigan Technological Univ.**
COOPERATIVE EVALUATION OF TECHNIQUES FOR
MEASURING NITRIC OXIDE AND CARBON MONOX-
IDE (PHASE 4 TESTS)
HS-017 443
- CRC EVALUATION OF TECHNIQUES FOR MEASUR-
ING HYDROCARBONS IN DIESEL EXHAUST. PHASE
4
HS-017 442
- Minicars, Inc., 35 La Patera Lane, Goleta, Calif. 93017**
INFLATABLE BELT DEVELOPMENT FOR SUBCOM-
PACT CAR PASSENGERS. FINAL REPORT
HS-801 719
- INFLATABLE BELT DEVELOPMENT FOR SUBCOM-
PACT CAR PASSENGERS. EXECUTIVE SUMMARY.
FINAL REPORT
HS-801 720
- SUBCOMPACT CAR CRASHWORTHINESS PROGRAM.
PROGRESS REPORT FOR JUNE AND JULY, 1975
HS-801 723
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PROGRESS REPORT, AUGUST 1975
HS-801 749
- Ministry of Transport, Road and Motor Vehicle Traffic
Safety, Ottawa, Ont., Canada**
THE SEAT BELT ARGUMENT
HS-017 566
- Ministry of Transport, Road and Motor Vehicle Traffic
Safety, Ottawa, Canada**
MOTORCYCLE TRAINING-STANDARDS FOR SUR-
VIVAL
HS-017 570
- Ministry of Transport, Road Safety Unit, Downsview,
Ont., Canada**
DRIVER PERFORMANCE RELATED TO THE VEHI-
CLE
HS-017 564
- Ministry of Transport, Traffic Engineering Sec., Private
Bag, Wellington, New Zealand**
DRIVER RECALL OF ROADSIDE SIGNS
HS-017 456
- Mitsubishi Motors Corp., Japan**
PISTON SLAP NOISE OF INDIRECT COMBUSTION
DIESEL ENGINE
HS-017 534
- Motor Vehicle Mfgs. Assoc. of the United States, Inc.,
Statistics Dept., 320 New Center Bldg., Detroit, Mich. 48202**
1975 MOTOR TRUCK FACTS
HS-017 557
- N. D. Lea Transportation Res. Corp.**
NEW TRANSIT MODES: APPLICABILITY AND CUR-
RENT STATUS
HS-017 449
- National Aeronautics and Space Administration, Langley
Res. Center, Hampton, Va. 23665**
A UNIQUE CONCEPT FOR AUTOMATICALLY CON-
TROLLING THE BRAKING ACTION OF WHEELED
VEHICLES DURING MINIMUM DISTANCE STOPS
HS-017 501
- National Bureau of Standards, Technical Analysis Div.,
Washington, D.C. 20234**
ANALYSIS OF METHODOLOGY FOR MEASURING
NATIONAL HIGHWAY TRAFFIC SAFETY. FINAL RE-
PORT
HS-801 741
- National Bureau of Standards, Washington, D.C. 20234**
CONSIDERATIONS IN THE USE OF SAMPLING
PLANS FOR EFFECTING COMPLIANCE WITH MAN-
DATORY SAFETY STANDARDS. FINAL REPORT
HS-017 426
- National Com. on Uniform Traffic Laws and Ordinances**
ACCIDENT INVESTIGATION AND REPORTING
HS-801 750
- National Hwy. Traffic Safety Administration**
INTERNATIONAL CONGRESS ON AUTOMOTIVE
SAFETY (4TH) PROCEEDINGS, JULY 14-16, 1975
HS-801 745
- TRAFFIC SAFETY HIGHLIGHTS, PROBLEMS AND
PROGRAMS. A SUMMARY REVIEW, JUNE 1974
THROUGH JUNE 1975
HS-801 755

| | | | |
|--|------------|---|------------|
| COMPENDIUM OF PEDESTRIAN-BICYCLE SAFETY PROGRAMS | HS-017 471 | ACCIDENT FACTS, 1975 EDITION | HS-017 460 |
| National Hwy. Traffic Safety Administration, Mathematical Analysis Div., Washington, D.C. 20590 | | Ohio Dept. of Transportation, 25 South Front St., Columbus, Ohio 43215 | |
| THE EFFECT OF THE FUEL SHORTAGE ON TRAVEL AND HIGHWAY SAFETY | HS-801 715 | HIGHWAY METRICATION. VOL. 1. TASKS 1, 2, 3, 4, AND APERCU. FINAL REPORT | HS-017 483 |
| National Hwy. Traffic Safety Administration, Office of Driver and Pedestrian Res. | | HIGHWAY METRICATION. VOL. 2. APPENDIXES. FINAL REPORT | HS-017 484 |
| EFFECT OF PASSENGER LOADING ON DRIVER'S VISIBILITY (FIELD OF VIEW) FROM AUTOMOBILES | HS-801 743 | Ontario Ministry of Transportation and Communications, Downsview, Ont., Canada | |
| National Hwy. Traffic Safety Administration, Planning and Evaluation, Washington, D.C. | | COUNTERMEASURES--A COMMUNITY BASED CAMPAIGN FOR THE PREVENTION OF DRUNK DRIVING: AN EXPERIMENTAL EVALUATION | HS-017 560 |
| STATEWIDE HIGHWAY SAFETY PROGRAM ASSESSMENT. A NATIONAL ESTIMATE OF PERFORMANCE. JULY, 1975 | HS-801 742 | METHODS OF MEASURING DRIVER BEHAVIOUR [BEHAVIOR] | HS-017 565 |
| National Hwy. Traffic Safety Administration, Washington, D. C. 20590 | | Perkins Engines Co., England | |
| MOTOR VEHICLE SAFETY DEFECT RECALL CAMPAIGNS--DETAILED REPORTS FROM APRIL 1 TO JUNE 30, 1975 | HS-801 662 | ENERGY ECONOMICS OF AUTOMOTIVE POWER GENERATION | HS-017 513 |
| National Hwy. Traffic Safety Administration, Washington, D.C. | | THE APPLICATION OF IDEALIZATION AND RESPONSE ANALYSIS TO DIESEL ENGINE NOISE ASSESSMENT | HS-017 541 |
| TRAFFIC SAFETY '74. A REPORT ON ACTIVITIES UNDER THE HIGHWAY SAFETY ACT OF 1966 | HS-801 699 | Perkins Engines, Ltd., England | |
| TRAFFIC SAFETY '74. A REPORT ON ACTIVITIES UNDER THE NATIONAL TRAFFIC AND MOTOR VEHICLE SAFETY ACT OF 1966 AND THE MOTOR VEHICLE INFORMATION AND COST SAVINGS ACT OF 1972. | HS-801 700 | ANALYSIS AND PREDICTION OF ENGINE STRUCTURE VIBRATION | HS-017 537 |
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| TIPS ON CAR CARE AND SAFETY FOR DEAF DRIVERS | HS-801 757 | ROLLING RESISTANCE OF PNEUMATIC TIRES. INTERIM REPORT | HS-017 519 |
| National Res. Council Canada, National Aeronautical Establishment, Ottawa, Canada | | Ricardo and Co. Engineers (1927) Ltd., England | |
| ANALYSIS OF DRIVER CONTROL MOVEMENTS ON A LIMITED-ACCESS DIVIDED HIGHWAY | HS-017 489 | THE EFFECT OF COMBUSTION SYSTEM ON ENGINE NOISES | HS-017 531 |
| MEASURED ILLUMINATION CHARACTERISTICS OF THE 1974 HEADLAMPS. PART 1. THE S.A.E. HEADLAMPS | HS-017 555 | Ricardo and Co. Engineers Ltd., England | |
| National Res. Council, Transportation Res. Board, Washington, D.C. | | A LIGHT DUTY DIESEL FOR AMERICA? | HS-017 487 |
| TRANSPORTATION PROGRAMMING PROCESS. PROCEEDINGS OF A CONFERENCE, ORLANDO, FLORIDA, 23-26 MARCH 1975. | HS-017 482 | Ricardo and Co. Engineers 1927 Ltd., England | |
| | | THE LIGHT DUTY DIESEL ENGINE FOR PRIVATE TRANSPORTATION | HS-017 488 |
| | | Robert Bosch GmbH, West Germany | |
| | | INJECTION NOISE AND ITS RELATION TO FUEL PUMP AND ENGINE NOISE | HS-017 535 |
| | | Rocket Res. Corp., 11441 Willows Rd., Redmond, Wash. 98052 | |
| | | DEVELOPMENT OF IMPROVED INFLATION TECHNIQUES. FINAL REPORT | HS-801 724 |

**Royal Ulster Constabulary, Traffic Div. Headquarters,
Alexander Rd., Belfast, Northern Ireland**
DEATH AND INJURY ROAD ACCIDENTS IN
NORTHERN IRELAND, 1974

HS-017 436

**Rutgers Univ., Center of Alcohol Studies, New
Brunswick, N.J.**
COMMENTS ON ALCOHOL INVOLVEMENT IN
FATAL AND NON-FATAL CRASHES

HS-017 562

**Sir W. G. Armstrong Whitworth and Co., (Engineers)
Ltd., England**
LOW NOISE OPPOSED PISTON TWO-STROKE EN-
GINE AND BLOWER

HS-017 545

**Society of Automotive Engineers, Inc., 400
Commonwealth Drive, Warrendale, Pa. 15096**
ENGINEERING KNOW-HOW IN ENGINE DESIGN.
PART 23. ENGINE DESIGN TO MEET NEW SOCIAL
OBLIGATIONS

HS-017 522

DIESEL ENGINE NOISE CONFERENCE

HS-017 527

Southwest Res. Inst.
DIESEL EMISSION CONTROL THROUGH RETROFITS
EMISSIONS AND ECONOMY OF FOUR DIESEL CARS

HS-017 444

HS-017 582

**Southwest Res. Inst., P. O. Drawer 28510, San Antonio,
Tex. 78284**
UNIFORM TIRE QUALITY GRADING-TREADWEAR.
CITY TEST. FINAL REPORT

HS-801 735

Stevens Inst. of Tech.
A CYBERNETICALLY COUPLED RESEARCH VEHI-
CLE [CCRV]

HS-017 451

**Systems Technology, Inc., 13766 South Hawthorne Blvd.,
Hawthorne, Calif. 90250**
EFFECTS OF INTERMIXING OF BIAS, BIAS BELTED,
AND RADIAL PLY PASSENGER TIRES ON VEHICLE
DYNAMICS AND DRIVER/VEHICLE RESPONSES.
FINAL REPORT

HS-801 702

**Teledyne Brown Engineering, Cummings Res. Park,
Huntsville, Ala. 35807**
EVALUATION OF GLARE REDUCTION
TECHNIQUES. FINAL REPORT

HS-801 718

Texaco Inc.
THE TEXACO IGNITION SYSTEM--A NEW CONCEPT
FOR AUTOMOTIVE ENGINES

HS-017 583

Texas A and M Univ., College Station, Tex.
CRASH CUSHIONS OF WASTE MATERIALS

HS-017 430

**Texas Transportation Inst., Texas A and M Univ.,
College Station, Tex. 77843**
TIRE-PAVEMENT FRICTION AS A FUNCTION OF
VEHICLE MANEUVERS. FINAL REPORT

HS-017 427

**Texas Transportation Inst., Texas A and M Univ.,
College Station, Tex. 77843**
FULL SCALE CRASH TESTS OF A TIRE-SAND INER-
TIA BARRIER. INTERIM REPORT

HS-017 462

Textron Corp., Homelite Div.
REDUCING THE TRANSMITTED VIBRATIONS FROM
SINGLE CYLINDER ENGINES

HS-017 525

Traffic Injury Res. Foundation of Canada
TRAFFIC SAFETY. PROCEEDINGS OF THE SCIENTI-
FIC CONFERENCE, OTTAWA, ONTARIO, CANADA,
MAY 23 AND 24, 1974

HS-017 559

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Medical Care Study, Ottawa, Canada**
QUALITY MEASUREMENT OF EMERGENCY MEDI-
CAL CARE

HS-017 572

**Ultrasystem, Inc., Dynamic Science Div., 1850 West
Pinnacle Peak Rd., Phoenix, Ariz. 85027**
SPILLED FUEL IGNITION SOURCES AND COUNTER-
MEASURES. FINAL REPORT

HS-801 722

**Ultrasystems Inc., Dynamic Science Div., 1850 West
Pinnacle Peak Rd., Phoenix, Ariz. 85027**
ACCIDENT AVOIDANCE TEST REPORT--NISSAN AND
TOYOTA EXPERIMENTAL SAFETY VEHICLES.
FINAL TEST REPORT

HS-801 713

**Ultrasystems, Inc., Dynamic Science Div., 1850 West
Pinnacle Peak Rd., Phoenix, Ariz. 85027**
AUTOMATIC VEHICLE CONTROLLER. OPERATOR'S
AND MAINTENANCE MANUAL

HS-801 716

**Ultrasystems, Inc., Dynamic Science Div., 1850 West
Pinnacle Peak Rd., Phoenix, Ariz. 85023**
TESTING OF FOREIGN PROTOTYPE EXPERIMENTAL
SAFETY VEHICLES--PROGRAM SUMMARY REPORT.
FINAL REPORT

HS-801 717

**Ultrasystems, Inc., Dynamic Science Div., 1850 West
Pinnacle Peak Road, Phoenix, Ariz. 85027**
SPILLED FUEL IGNITION SOURCES AND COUNTER-
MEASURES. SUMMARY REPORT. FINAL REPORT

HS-801 744

United States Army
THREE GENERATIONS OF SOVIET WHEELED MILI-
TARY TRANSPORT VEHICLES

HS-017 452

March 31, 1976

**University of Alberta, Applied Psychology Unit,
Edmonton T6G 2E1, Alta., Canada**

EVALUATING THE EFFECTIVENESS OF REEDUCATION PROGRAMS FOR CONVICTED [ALCOHOL] IMPAIRED DRIVERS

HS-017 458

**University of Birmingham, Accident Res. Unit,
Birmingham, England**

SERIOUS TRAUMA TO CAR OCCUPANTS WEARING SEAT BELTS

HS-017 494

**University of Calgary, Dept. of Psychology, Calgary,
Alta., Canada**

DRIVER ROAD SIGN INTERACTION

HS-017 563

**University of California at Los Angeles, Div. of Res., 405
Hilgard Ave., Los Angeles, Calif. 90024**

METHODOLOGIES FOR THE EVALUATION AND IMPROVEMENT OF EMERGENCY MEDICAL SERVICE SYSTEMS. VOL. 2. APPENDICES. FINAL REPORT

HS-801 704

**University of Illinois, Dept. of Theoretical and Applied
Mechanics**

EFFECTS OF GRAPHITE MORPHOLOGY, MATRIX HARDNESS, AND STRUCTURE ON THE FATIGUE RESISTANCE OF GRAY CAST IRON

HS-017 441

**University of Michigan, Hwy. Safety Res. Inst., Ann
Arbor, Mich. 48104**

EXPERIMENTAL AND COMPUTER SIMULATION EVALUATION OF HEADLAMP BEAMS

HS-017 457

**University of Michigan, Hwy. Safety Res. Inst., Ann
Arbor, Mich. 48105**

REAR-IMPACTED VEHICLE COLLISIONS: FREQUENCIES AND CASUALTY PATTERNS. FINAL REPORT

HS-017 461

EYE FIXATIONS OF DRIVERS IN NIGHT DRIVING WITH THREE HEADLIGHT [HEADLAMP] BEAMS. FINAL REPORT

HS-017 547

**University of Michigan, Hwy. Safety Res. Inst., Huron
Pkwy. and Baxter Rd., Ann Arbor, Mich. 48105**

EFFECTS OF THE ENERGY CRISIS AND 55 MPH

SPEED LIMIT IN MICHIGAN. FINAL REPORT

HS-017 463

**University of Missouri, School of Pharmacy, Kansas
City, Mo. 64108**

THE DEVELOPMENT OF TECHNOLOGY FOR DETECTION OF MARIJUANA INTOXICATION BY ANALYSIS OF BODY FLUIDS. FINAL REPORT

HS-801 721

**University of Ottawa, Dept. of Mechanical Engineering,
Ottawa, Ont., Canada**

THE PROTECTIVE VALUE OF CONTEMPORARY MOTORCYCLE HELMETS IN THE PREVENTION OF HEAD INJURIES

HS-017 569

**University of Southampton, Automotive Engineering
Group, England**

THE PROBLEMS OF NOISE OF ENGINES IN DIFFERENT VEHICLE GROUPS

HS-017 528

EFFECT OF TURBOCHARGING ON DIESEL ENGINE NOISE, EMISSIONS AND PERFORMANCE

HS-017 530

**University of Southampton, Inst. of Sound and Vibration
Res., England**

MODES OF ENGINE STRUCTURE VIBRATION AS A SOURCE OF NOISE

HS-017 538

LOW NOISE OPPOSED PISTON TWO-STROKE ENGINE AND BLOWER

HS-017 545

**University of Uppsala, Dept. of Psychology, Box 227,
75104 Uppsala, Sweden**

INTERINDIVIDUAL DIFFERENCES IN MESOPIC NIGHT VISION ABILITY MEASURED BY THE MESOPTOMETER

HS-017 481

University of Wisconsin, Mechanical Engineering Dept.

COMBUSTION PROCESS FUNDAMENTALS AND COMBUSTION CHAMBER DESIGN FOR LOW EMISSIONS

HS-017 523

Wellworthy, Ltd., England

TRANSVERSE MOVEMENT ANALYSIS AND ITS INFLUENCE ON DIESEL PISTON DESIGN

HS-017 533

Contract Number Index

| | |
|--|---|
| AIR-330E International Harvester Co., Solar Div. San Diego, Calif. HS-017 445 | Ultrasystems, Inc., Dynamic Science Div., 1850 West Pinnacle Peak Road, Phoenix, Ariz. 85027 HS-801 744 |
| DA-44-188-ARO-2 George Washington Univ., Human Resources Res. Organization (HumRRO), 300 North Washington St., Alexandria, Va. 22314 HS-017 508 | DOT-HS-4-00898 Highway Safety Res. Inst., Huron Pkwy. and Baxter Rd., Ann Arbor, Mich. 48105 HS-801 733 |
| DAAEO7-72-C-0164 Army Tank-Auto. Command; Stevens Inst. of Tech. HS-017 451 | DOT-HS-4-00917 Minicars, Inc., 35 La Patera Lane, Goleta, Calif. 93017 HS-801 719 |
| DAAEO7-74-C-0185 Army Tank-Auto. Command; Stevens Inst. of Tech. HS-017 451 | Minicars, Inc., 35 La Patera Lane, Goleta, Calif. 93017 HS-801 720 |
| DAAEO7-73-C-0331 Foster-Miller Assocs., Inc., 135 Second Ave., Waltham, Mass. 02154 HS-017 548 | DOT-HS-4-00922 Calspan Corp., Buffalo, N.Y. 14221 HS-801 751 |
| DAAJO2-73-C-0086 Mechanical Technology Inc. HS-017 448 | DOT-HS-4-00925 Teledyne Brown Engineering, Cummings Res. Park, Huntsville, Ala. 35807 HS-801 718 |
| DOT-HS-113-3-746 Minicars, Inc., 35 La Patera Lane, Goleta, Calif. 93017 HS-801 723 | DOT-HS-4-00928 National Com. on Uniform Traffic Laws and Ordinances HS-801 750 |
| Minicars, Inc., 35 La Patera Lane, Goleta, Calif. 93017 HS-801 749 | DOT-HS-4-00947 Applied Science Assocs., Inc., Box 158, Valencia, Pa. 16059 HS-801 659 |
| DOT-HS-207-2-337 American Assoc. of Community and Junior Colleges, One Dupont Circle, N.W., Washington, D.C. 20036 HS-801 746 | DOT-HS-4-00968 University of Missouri, School of Pharmacy, Kansas City, Mo. 64108 HS-801 721 |
| DOT-HS-243-2-424 Franklin Inst. Res. Labs., 20th and Race Sts., Philadelphia, Pa. 19103 HS-801 710 | DOT-HS-4-00972 Calspan Corp., Buffalo, N.Y. 14221 HS-801 752 |
| Franklin Inst. Res. Labs., 20th and Race Sts., Philadelphia, Pa. 19103 HS-801 711 | DOT-HS-4-00986 Dunlap and Assocs., Inc., One Parkland Drive, Darien, Conn. 06820 HS-801 732 |
| DOT-HS-344-3-690 Rocket Res. Corp., 11441 Willows Rd., Redmond, Wash. 98052 HS-801 724 | DOT-HS-4-00987 Dunlap and Assocs., Inc., 1 Parkland Drive, Darien, Conn. 06820 HS-801 731 |
| DOT-HS-4-00860 Ultrasystems Inc., Dynamic Science Div., 1850 West Pinnacle Peak Rd., Phoenix, Ariz. 85027 HS-801 713 | DOT-HS-5-01070 Southwest Res. Inst., P. O. Drawer 28510, San Antonio, Tex. 78284 HS-801 735 |
| Ultrasystems, Inc., Dynamic Science Div., 1850 West Pinnacle Peak Rd., Phoenix, Ariz. 85027 HS-801 716 | DOT-HS-5-01080 Systems Technology, Inc., 13766 South Hawthorne Blvd., Hawthorne, Calif. 90250 HS-801 702 |
| Ultrasystems, Inc., Dynamic Science Div., 1850 West Pinnacle Peak Rd., Phoenix, Ariz. 85023 HS-801 717 | DOT-HS-5-01214 Calspan Corp., Buffalo, N. Y. 14221 HS-801 730 |
| DOT-HS-4-00872 Ultrasystem, Inc., Dynamic Science Div., 1850 West Pinnacle Peak Rd., Phoenix, Ariz. 85027 HS-801 722 | DOT-TSC-316 Regents of the Univ. of Michigan, Ann Arbor, Mich. 48104 HS-017 519 |

FH-11-6849

University of California at Los Angeles, Div. of Res., 405
Hilgard Ave., Los Angeles, Calif. 90024

HS-801 704

University of California at Los Angeles, Div. of Res., 405
Hilgard Ave., Los Angeles, Calif. 90024

HS-801 705

FH-11-8251

Alan M. Voorhees and Associates, Inc., Westgate Res. Park,
McLean, Va. 22101

HS-017 503

FH-11-8309

Ohio Dept. of Transportation, 25 South Front St., Colum-
bus, Ohio 43215

HS-017 483

Ohio Dept. of Transportation, 25 South Front St., Colum-
bus, Ohio 43215

HS-017 484

F33615-71-C-1510

International Harvester Co., Solar Div. San Diego, Calif.

HS-017 445

HUD-H-1212

City of Reading, USAC Proj., P. O. Box 7, Reading, Pa.
19603

HS-017 435

NHTSA-5-1673

Kappa Systems, Inc., 1501 Wilson Blvd., Arlington, Va.
22209

N00010-69-C-0683

International Harvester Co., Solar Div. San Diego, Calif.

HS-017 445

N00014-70-A-0311-0003

Clarkson Coll. of Tech., Potsdam, N.Y. 13676

HS-017 556

Clarkson Coll. of Technology, Dept. of Mechanical and In-
dustrial Engineering, Potsdam, N. Y. 13676

HS-017 434

N00019-71-C-02888

International Harvester Co., Solar Div. San Diego, Calif.

HS-017 445

Ref. EPA-PH-22-68-23

Southwest Res. Inst.; Environmental Protection Agency

HS-017 582

Ref. PH-22-68-23

Southwest Res. Inst.; Environmental Protection Agency

HS-017 444

UM-7102-C128

University of Michigan, Hwy. Safety Res. Inst., Ann Arbor,
Mich. 48105

HS-017 547

013454

University of Michigan, Hwy. Safety Res. Inst., Huron
Pkwy. and Baxter Rd., Ann Arbor, Mich. 48105

HS-017 463

Report Number Index

| | | | |
|-----------------------|------------|-----------------|------------|
| AD-A005415 | | NASA-TM-X-72665 | |
| AD-A008-250-3 | HS-017 548 | | HS-017 501 |
| AD-A011097 | HS-017 433 | NBSIR-74-561 | HS-801 741 |
| AD-A012315 | HS-017 556 | NBSIR-75-697 | HS-017 426 |
| ASA-367 | HS-017 508 | NCHRP-157 | HS-017 430 |
| DOT-TSC-OST-74-33 | HS-801 659 | NRC-14811 | HS-017 489 |
| Exploratory-Study-20 | HS-017 519 | NTSB-HAR-75-3 | HS-017 491 |
| EE-DOT-1905 | HS-017 508 | N75-23987 | HS-017 501 |
| EPA-550/9-75-025 | HS-801 718 | ODOT-3 | HS-017 483 |
| F-C3417 | HS-017 521 | Pub-1975-1E | HS-017 484 |
| File-813.51 | HS-801 710 | PB-238 940 | HS-017 431 |
| FAA-TR-FS-75-782-120A | HS-801 711 | PB-239 916 | HS-017 504 |
| FHWA-RD-74-24 | HS-017 469 | PB-242 985 | HS-017 503 |
| FHWA-RD-75-5 | HS-017 553 | PR-Aug-75 | HS-017 519 |
| FHWA-RD-75-68 | HS-017 520 | PR-Jul-75 | HS-801 749 |
| FHWA-RD-75-69 | HS-017 503 | PR-Jun-75 | HS-801 723 |
| GMR-1711 | HS-017 483 | PR-1 | HS-801 723 |
| HSRI-30558 | HS-017 484 | PR-10 | HS-801 730 |
| IZF-1974-C12 | HS-017 464 | PR-11 | HS-801 751 |
| LTR-ST-783 | HS-017 457 | PR-12 | HS-801 751 |
| MIE-009 | HS-017 470 | PR-13 | HS-801 751 |
| MIE-010 | HS-017 555 | PR-14 | HS-801 752 |
| NAE-MS-136 | HS-017 434 | PR-15 | HS-801 752 |
| | HS-017 556 | PR-6 | HS-017 470 |
| | HS-017 489 | | |

| | | | |
|------------|------------|------------|-----------|
| PR-7 | HS-801 751 | SAE-750330 | HS-017 48 |
| PR-8 | HS-801 751 | SAE-750331 | HS-017 48 |
| PR-9 | HS-801 751 | SAE-750332 | HS-017 50 |
| RR-146-12 | HS-017 462 | SAE-750347 | HS-017 50 |
| SAE-SP-396 | HS-017 522 | SAE-750540 | HS-017 50 |
| SAE-SP-397 | HS-017 527 | SAE-750761 | HS-017 50 |
| SAE-741035 | HS-017 437 | SAE-750795 | HS-017 50 |
| SAE-750195 | HS-017 438 | SAE-750796 | HS-017 50 |
| SAE-750196 | HS-017 439 | SAE-750797 | HS-017 50 |
| SAE-750197 | HS-017 440 | SAE-750798 | HS-017 50 |
| SAE-750198 | HS-017 441 | SAE-750799 | HS-017 50 |
| SAE-750203 | HS-017 442 | SAE-750800 | HS-017 50 |
| SAE-750204 | HS-017 443 | SAE-750801 | HS-017 50 |
| SAE-750205 | HS-017 444 | SAE-750802 | HS-017 50 |
| SAE-750206 | HS-017 445 | SAE-750803 | HS-017 50 |
| SAE-750207 | HS-017 446 | SAE-750832 | HS-017 50 |
| SAE-750208 | HS-017 447 | SAE-750833 | HS-017 50 |
| SAE-750209 | HS-017 448 | SAE-750834 | HS-017 50 |
| SAE-750214 | HS-017 449 | SAE-750835 | HS-017 50 |
| SAE-750216 | HS-017 450 | SAE-750836 | HS-017 50 |
| SAE-750217 | HS-017 451 | SAE-750837 | HS-017 50 |
| SAE-750219 | HS-017 452 | SAE-750838 | HS-017 50 |
| SAE-750220 | HS-017 453 | SAE-750839 | HS-017 50 |
| SAE-750221 | | SAE-750840 | |

March 31, 1976

| | | | |
|--------------------|------------|----------------------|------------|
| SAE-751001 | HS-017 523 | UM-HSRI-SA-75-6 | HS-017 461 |
| SAE-751002 | HS-017 524 | UM-HSRI-SA-75-9 | HS-801 733 |
| SAE-751003 | HS-017 525 | UMTA-DC-11-0003-74-3 | HS-017 463 |
| SAE-751004 | HS-017 526 | USAC-RPA5-7052 | HS-017 504 |
| SS-H-32 | HS-017 491 | 1/75 | HS-017 435 |
| TAC-7333 | HS-017 548 | 177 | HS-017 518 |
| TR-1060-1 | HS-801 702 | 2310-75-116 | HS-017 481 |
| TR-11877 | HS-017 548 | 2310-75-117 | HS-801 713 |
| TRB-SR-157 | HS-017 482 | 2310-75-118 | HS-801 717 |
| TTI-2-10-72-163-2F | HS-017 427 | 2310-75-119 | HS-801 722 |
| UM-HSRI-HF-74-17 | HS-017 547 | 75-1 | HS-801 744 |
| UM-HSRI-SA-75-2 | | | HS-017 478 |



CONTRACTS AWARDED

DOT-HS-031-3-722 Mod. 7

ALCOHOL SAFETY ACTION PROJECT

The contractor shall process roadside surveys from Idaho, Minnesota, Puerto Rico, and Utah ASAP's in conformance with the national archive requirements and formats through 31 Aug 1976.

Regents of the University of Michigan, Office of Research Administration, Ann Arbor, Mich. 48105

No change

DOT-HS-034-3-535 Mod. 6

TRI-LEVEL STUDY OF THE CAUSES OF TRAFFIC ACCIDENTS

Indiana University Foundation, Box F, Bloomington, Ind. 47401

No change

DOT-HS-038-1-045 Mod. 19

ALCOHOL SAFETY ACTION PROJECT

South Carolina Commission on Alcoholism, 1611 Devonshire Drive, Columbia, S.C. 29204

No change

DOT-HS-045-1-061 Mod. 26

ALCOHOL SAFETY ACTION PROJECT

State of South Dakota, Department of Public Safety, Division of Highway Safety, Pierre, S.Dak. 57501

No change

DOT-HS-048-1-064 Mod. 25

ALCOHOL SAFETY ACTION PROJECT

The Department of Public Safety, State of Minnesota, 211 Highway Building, St. Paul, Minn. 55101

No change

DOT-HS-049-1-065 Mod. 23

ALCOHOL SAFETY ACTION PROJECT

Alcohol Safety Action Project, City of San Antonio, 303 South Alamo Street, San Antonio, Tex. 78203

No change

DOT-HS-051-1-067 Mod. 25

ALCOHOL SAFETY ACTION PROJECT

City of Oklahoma City, Alcohol Safety Action Project, 529 Hightower Building, 105 North Hudson, Oklahoma City, Okla. 73102

No change

DOT-HS-059-1-076 Mod. 21

ALCOHOL SAFETY ACTION PROJECT

City of New Orleans, Alcohol Safety Action Project, 545 St. Charles Avenue, Room 302, New Orleans, La. 70130

No change

DOT-HS-075-1-098 Mod. 16

ALCOHOL SAFETY ACTION PROJECT

Massachusetts Health Research Institute, Inc., 600 Washington St., Suite 625, Boston, Mass. 02111

No change

DOT-HS-077-1-100 Mod. 16

ALCOHOL SAFETY ACTION PROJECT

City of Kansas City, 12th. and Oak Street, Kansas City, Mo. 64106

No change

DOT-HS-160-2-445 Mod. 5

DOT-HS-123-3-774 Mod. 1

**EFFECTIVE HIGHWAY SAFETY TRAFFIC OFFENSE
ADJUDICATION**

Arthur Young and Company, 1025 Connecticut Avenue,
Washington, D.C. 20036

No change

DOT-HS-160-2-445 Mod. 5

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

Commonwealth of Puerto Rico, Highway Safety Commission,
P. O. Box 8036, Santurce, P.R. 00910

Extended to 31 Dec 1976

DOT-HS-161-2-252 Mod. 9

ALCOHOL SAFETY ACTION PROJECT

The contractor will prepare four annual reports commencing 1
January 1972 and ending 1 January 1976. For calendar year
1976, specific tables will be submitted on a quarterly or
monthly basis.

County of Los Angeles, Alcohol Safety Action Project, Suite
700, 311 South Spring Street, Los Angeles, Calif. 90013

Extended to 30 Jun 77

DOT-HS-206-2-335 Mod. 9

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Missouri, Division of Highway Safety, 2634 Industrial
Drive, Jefferson, Mo. 65101

Extended to 31 Dec 1976

DOT-HS-211-2-360 Mod. 7

FATALITY ACCIDENT RECORDS SYSTEMS (FARS)

State of Maryland, Maryland State Police, Pikesville, Md.
21208

Extended to 31 Dec 1976

HSL 76-03

DOT-HS-218-2-372 Mod. 5

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

Commonwealth of Pennsylvania, Department of
Transportation, Harrisburg, Pa. 17120

Extended to 31 Dec 1976

DOT-HS-232-2-399 Mod. 5

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Georgia, Department of Public Safety, P.O. Box 1456
Atlanta, Ga. 30301

Extended to 31 Dec 1976

DOT-HS-233-2-400 Mod. 5

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Alabama, Department of Public Safety, 500 Dexter
Avenue, Montgomery, Ala.

Extended to 31 Dec 1976

DOT-HS-239-2-413 Mod. 7

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Washington, Department of Motor Vehicles, Olympia
Wash. 98504

Extended to 31 Dec 1976

DOT-HS-242-2-436 Mod. 6

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Tennessee, Highway Safety Planning Division, Suite
950, Capitol Hill Building, 301 Seventh Avenue, North,
Nashville, Tenn. 37219

Extended to 31 Dec 1976

DOT-HS-244-2-426 Mod. 5

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of New Jersey, Office of Highway Safety, 4 Scotch
Road, Trenton, N.J. 08628

March 31, 1976

DOT-HS-245-2-428 Mod. 8

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of New York, Department of Motor Vehicles, Div. of
R&D, South Mall, Albany, N.Y. 12228

Extended to 31 Dec 1976

DOT-HS-247-2-434 Mod. 7

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Kentucky, Department of Public Safety, Division of
Kentucky State Police, State Office Building, Frankfort, Ky.
40601

Extended to 31 Dec 1976

DOT-HS-247-2-493 Mod. 4

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Mississippi, Department of Public Safety, P. O. Box
958, Jackson, Miss. 39205

Extended to 31 Dec 1976

DOT-HS-248-2-494 Mod. 4

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

Department of State Police, P.O. Box 27472, Richmond, Va.
23261

Extended to 31 Dec 1976

DOT-HS-250-2-439 Mod. 5

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Florida, Dept. of Highway Safety & Motor Vehicles,
Neil Kirkman Building, Tallahassee, Fla. 32304

Extended to 31 Dec 1976

DOT-HS-274-2-526 Mod. 6

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Iowa, Department of Transportation, Motor Vehicles
Division, 5238 N.W. 2nd Avenue, Des Moines, Iowa 50319

Extended to 31 Dec 1976

DOT-HS-283-3-538 Mod. 5

DOT-HS-275-3-527 Mod. 4

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Illinois, 2300 So. Dirksen Parkway, Springfield, Ill.
62764

Extended to 31 Dec 1976

DOT-HS-275-3-529 Mod. 8

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Arkansas, Public Safety Program, 116 National Old
Line Bldg., Little Rock, Ark. 72201

Extended to 31 Dec 1976

DOT-HS-277-3-530 Mod. 5

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Ohio, Department of Highway Safety, 240 South
Parsons Avenue, Columbus, Ohio 43205

Extended to 31 Dec 1976

DOT-HS-281-3-536 Mod. 5

FATALITY ACCIDENT RECORDS SYSTEMS (FARS)

State of Utah, Highway Safety Division, Denver Building,
Suite 300, 352 Denver Street, Salt Lake City, Utah 84111

Extended to 31 Dec 1976

DOT-HS-282-3-537 Mod. 5

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of South Dakota, South Dakota Department of Public
Highway Safety - State and Community Programs, 108 East
Missouri Avenue, Pierre, S.Dak. 57501

Extended to 31 Dec 1976

DOT-HS-283-3-538 Mod. 5

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Montana, Highway Traffic Safety Division, Capitol
Station, Helena, Mont. 59601

Extended to 31 Dec 1976

DOT-HS-284-3-539 Mod. 6

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of North Dakota, Highway Department - Capitol
Grounds, Traffic Engineering Division, Bismarck, N.Dak.
58501

Extended to 31 Dec 1976

DOT-HS-286-3-546 Mod. 4

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Oklahoma, Highway Safety Programs, 1118 United
Founders Tower, Oklahoma City, Okla. 73112

Extended to 31 Dec 1976

DOT-HS-287-3-547 Mod. 4

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Louisiana, Highway Safety Commission, P.O. Box
44061, Capitol Station, Baton Rouge, La. 70804

Extended to 31 Dec 1976

DOT-HS-294-3-560 Mod. 4

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Rhode Island, Office of Highway Safety, Providence,
R.I. 09203

Extended to 31 Dec 1976

DOT-HS-296-3-561 Mod. 4

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

New Mexico Traffic Safety Comm., 339 P.E.R.A. Building,
Santa Fe, N.Mex. 87501

Extended to 31 Dec 1976

DOT-HS-296-3-562 Mod. 4

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Nebraska, Department of Roads, Statehouse Station,
P.O. Box 94759, Lincoln, Nebr. 68509

Extended to 31 Dec 1976

DOT-HS-297-3-566 Mod. 4

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

Texas Department of Public Safety, 5805 No. Lamar
Boulevard, Box 4087, Austin, Tex. 78773

Extended to 31 Dec 1976

DOT-HS-298-3-567 Mod. 4

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Maine, Motor Vehicles Division, 242 State Street,
Augusta, Maine 04330

Extended to 31 Dec 1976

DOT-HS-300-3-573 Mod. 5

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Wyoming, Wyoming Highway Department, P.O. Box
1708, Cheyenne, Wyo. 82001

Extended to 31 Dec 1976

DOT-HS-301-3-574 Mod. 4

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Wisconsin, Division of Motor Vehicles, 4802
Sheboygan Avenue, Madison, Wisc. 53702

Extended to 31 Dec 1976

DOT-HS-302-3-575 Mod. 4

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Vermont, Department of Motor Vehicles, 120 State
Street, Montpelier, Vt. 05602

Extended to 31 Dec 1976

DOT-HS-305-3-579 Mod. 4

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

Commonwealth of Massachusetts, 146 Boudoir Street, Boston,
Mass. 02108

Extended to 31 Dec 1976

March 31, 1976

DOT-HS-306-3-580 Mod. 5

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Kansas, Department of Transportation, State Office Building, Topeka, Kans. 66612

Extended 31 Dec 1976

DOT-HS-307-3-581 Mod. 4

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of California, Office of Traffic Safety, 2570 - 24th Street, Sacramento, Calif. 95815

Extended 31 Dec 1976

DOT-HS-319-3-615 Mod. 5

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of West Virginia, 922 Quarrier Street, Charleston, W. Va. 25301

Extended to 31 Dec 1976

DOT-HS-320-3-616 Mod. 5

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Colorado, 4201 East Arkansas Avenue, Denver, Colo. 80222

Extended to 31 Dec 1976

DOT-HS-321-3-620 Mod. 4

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Alaska, Division of Technical Services, Pouch N, Juneau, Alaska 99801

Extended to 31 Dec 1976

DOT-HS-327-3-632 Mod. 4

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Idaho, Department of Highways, P.O. Box 7129, Boise, Idaho 83707

Extended to 31 Dec 1976

DOT-HS-338-3-651 Mod. 4

DOT-HS-328-3-633 Mod. 5

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Minnesota, 210 A Highway Building, St. Paul, Minn. 55155

Extended to 31 Dec 1976

DOT-HS-329-3-634 Mod. 5

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Hawaii, 869 Punchbowl Street, Honolulu, Hawaii 96813

Extended to 31 Dec 1976

DOT-HS-331-3-636 Mod. 4

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Oregon, Motor Vehicle Division, 1905 Lana Avenue, N.E., Salem, Oregon. 97310

Extended to 31 Dec 1976

DOT-HS-336-3-649 Mod. 4

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Indiana, Department of Highway Safety, 215 North Senate Avenue, Indianapolis, Ind. 46202

Extended to 31 Dec 1976

DOT-HS-337-3-650 Mod. 4

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of New Hampshire, Department of Safety, DMV, 85 Loudon Road, John O. Morton Building, Concord, N.H. 03301

Extended to 31 Dec 1976

DOT-HS-338-3-651 Mod. 4

FATALITY ACCIDENT RECORDS SYSTEM (FARS)

State of Michigan, Department of State Police, Office of Highway Safety Planning, 1048 Pierpoint Street, Lansing, Mich. 48910

Extended to 31 Dec 1976

PILOT DIAGNOSTIC INSPECTION DEMONSTRATION PROJECT

The following tasks as stipulated in the original contract were completed or dropped: evaluation exercises; service industries briefing; identification of the effect of diagnostic inspection on accidents; mobile inspection facility; and the operation of the motion picture mobile van. New and continuing assignments to be carried out by the contractor include: an equipment survey for procurement and evaluation purposes; the integration of inspection equipment and update of a computer system for diagnostic inspection; inspection demonstrations; inspector training; a brake inspection method study; and a method for evaluating fuel economy.

District of Columbia, Department of Motor Vehicles, 301 C Street, N. W., Washington, D. C. 20590

Extended to 1 Nov 75

DOT-HS-354-3-716 Mod. 6

PILOT DIAGNOSTIC INSPECTION DEMONSTRATION

The following tasks as stipulated in the original contract were transferred to contract DOT-HS-5-01098: evaluation exercises, and service industries briefing. The mobile inspection facility in Pennsylvania and the motion picture of mobile van operation tasks were completed. The task to identify the effect of diagnostic inspection on accidents was determined not to be cost-effective and was dropped. New and continuing assignments include: an equipment survey for procurement and evaluation purposes; integration of inspection equipment and computer system to define complete diagnostic inspection model; development and maintenance of the calibration manual; operation of mobile inspection vans; training inspectors; a brake inspection method study; and a method for evaluating fuel economy.

District of Columbia, Department of Motor Vehicles, 301 C Street, N.W., Washington, D.C. 20001

Extended to 30 Sep 1976

DOT-HS-4-00853 Mod. 5

HANDLING TEST PROCEDURES FOR LIGHT TRUCKS, VANS AND RECREATIONAL VEHICLES

The number of vehicles on which comprehensive tests are to be performed is reduced from five (5) to four (4) which will include the Class A motor home. The Class C motor home will not be tested.

Ultrasystems, Inc., Dynamic Science Division, 1850 W. Pinnacle Peak Road, Phoenix, Ariz. 85027

Extended to 15 Nov 75

DEVELOPMENT AND APPLICATION OF VEHICLES RATING CRITERIA FOR DAMAGE SUSCEPTIBILITY, CRASHWORTHINESS AND REPAIRABILITY

The contractor shall perform an ACIC Predictive Models Performance Evaluation, Task 1 Damage Model, Task 2 Occupant Response Model, and a Special Insurance Study.

General Electric Company, Information Systems Programs, 1400 Wilson Boulevard, Arlington, Va. 22209

No change

DOT-HS-4-00909 Mod. 4

CONSUMER INFORMATION CRASH TEST PROGRAM

Dynamic Science, 1850 West Pinnacle Peak Road, Phoenix, Ariz. 85027

No change

DOT-HS-4-00913 Mod. 3

COLLISION AVOIDANCE RADAR BRAKING SYSTEM INVESTIGATIONS

The Bendix Corporation, Research Laboratories, 20800 Ten and One-Half Mile Road, Southfield, Oakland, Mich. 48075

No change

DOT-HS-4-00920 Mod. 2

TIRE TREADWEAR VALIDATION

Hodges Transportation, Inc., Nevada Automotive Test Center, Post Office Box 234, Carson City, Nev. 89701

Extended to 30 Sep 75

DOT-HS-4-00932 Mod. 3

PASSENGER CAR BRAKING PERFORMANCE

Demonstration tests shall be performed on a 1975 Volvo and a 1975 Continental Mark 4. The vehicles shall be subjected to the tests recommended for a next generation braking standard. The tests shall include stops on a low coefficient surface and a curved path.

Ultrasystems, Inc., The Dynamic Science Division, 1850 West Pinnacle Peak Road, Phoenix, Ariz. 85027

To be completed 6 weeks from date of modification

**OPERATION AND MAINTENANCE OF THE NHTSA
FINANCIAL MANAGEMENT INFORMATION AND
ACCOUNTING SYSTEM (FMIA)**

Professional Services Division, Control Data Corporation,
6003 Executive Boulevard, Rockville, Md. 20852

Extended to 31 Dec 75

DOT-HS-4-00948 Mod. 2

PARTS RETURN PROGRAM

General Environments Corporation, 6840 Industrial Road,
Springfield, Va. 22151

No change

DOT-HS-4-00950 Del. Order 4

COMPLIANCE TESTING--SAFETY HELMETS

Seventy compliance tests of motorcycle helmets are to be conducted in accordance with FMVSS No. 218.

Southwest Research Institute, 8500 Culebra Road, San Antonio, Tex. 78234

No change

DOT-HS-4-00952 Mod. 2

**EXPERIMENTAL FIELD TESTING OF PROPOSED
PEDESTRIAN SAFETY MESSAGES**

The contractor shall provide Spanish language version of the media messages developed for the Vehicle Turn/Merge accident. This effort shall include: translation of original English-language scripts; all production operations; residuals on radio; increased distribution to Spanish-media outlets in Miami and San Diego; and inclusion of the Spanish-version into the telephone surveys designed to measure message transmission. Print/tape quantities of the messages shall consist of 25 copies each of 60 and 30 sec. radio and television spots.

Dunlap and Associates, One Parkland Drive, Darien, Conn. 06820

Extended to 30 Jun 1977

DOT-HS-4-00955 Mod.

**EXPERIMENTAL FIELD TEST OF PROPOSED ANIT-
DART-OUT TRAINING PROGRAMS**

In addition to providing all of the test activities to New Orleans which would normally have been applied to Miami, the

change, and materials transportation support to the New Orleans School System; and prepare an additional Phase 2 Interim Report on the activities and behavioral results.

Applied Science Associates, Inc., Box 158, Valencia, Pa. 16059

Extended to 1 Mar 1977

DOT-HS-4-00961 Mod.

**PEDESTRIAN IMPACTS: BASELINE AND
PRELIMINARY CONCEPTS EVALUATION**

The intent of this modification is to increase the number of specific tests in order to evaluate the pedestrian injury mitigating designs proposed by the two contractors developing Research Safety Vehicles (RSV) under NHTSA sponsorship. This modification will also increase the number of measurements currently specified for the cadaver tests to comply with NHTSA's new uniform instrumentation requirements. The contractor shall conduct a series of eight (8) impacts with each of two (2) RSV front end body bucks. Each series will include tests with both a 50th percentile dummy and a six-year-old dummy. A cadaver rib test is to be included.

Battelle Columbus Laboratories, 505 King Avenue, Columbus, Ohio 43201

No change

DOT-HS-4-00965 Mod. 2

**DEVELOPMENT OF NEW AND IMPROVED
COUNTERMEASURES PROGRAMS FOR ALCOHOL
RELATED HIGHWAY CRASHES**

National Safety Council, 425 North Michigan Avenue, Chicago, Ill. 60611

No change

DOT-HS-4-00969 Mod. 3

DEVELOPMENT OF A UNITIZED SCHOOL BUS

AMF, Inc., Advanced Systems Lab., 495 Fairview Ave., Goleta, Calif. 93017

No change

DOT-HS-4-00969 Mod. 4

DEVELOPMENT OF A UNITIZED SCHOOL BUS

The unitized bus design developed shall have at least three (3) emergency escape exits with two (2) being located on the roof and one in the rear. These shall be in addition to any windows

designed escape worthiness as a major consideration and shall have 17 inch by 24 inch minimum size openings. Features to be considered are to include: elevation of the driver's cab for improved field of view and improved driver safety during frontal impact; maintainability, producibility, repairability, reliability, and operability; and general overall improvement in safety features. The initial design for the seating structure shall include a passive restraint capability for each occupant, such as impact restraining bars and other protective devices to provide, to the extent possible, 360 degree energy absorbing capability in the horizontal plane for each occupant.

AMF, Inc., Advanced Systems Lab., 495 Fairview Avenue,
Goleta, Calif. 93017

No change

DOT-HS-4-00970 Mod. 3

TRAFFIC OFFENSE SENTENCING PROCESSES AND HIGHWAY SAFETY

The contractor shall develop computer programs for extracting data necessary for the study of habitual offender records from the North Carolina driver record file.

Public Systems, Inc., 1137 Kern avenue, Sunnyvale, Calif.
94086

Extended to 31 Dec 75

DOT-HS-4-01000 Mod. 2

DEVELOPMENT OF ADVANCED TRAFFIC ADJUDICATION TECHNIQUES

Four (4) additional bi-monthly bulletins are to be prepared for State officials. An additional workshop will be conducted in Region VII.

M. H. Wagner and Company, 9128 Christopher Street,
Fairfax, Va. 22030

Extended to 1 Mar 76

DOT-HS-4-01006 Mod. 1

ADVANCED HEADLIGHTING SYSTEMS

Honeywell Systems and Research Center, 2700 Ridgway
Parkway, Minneapolis, Minn. 55413

Extended to 27 Dec 75

CADAVER

The contractor shall test the GFP dummy as supplied to them
Calspan Corporation, P.O. Box 235, Buffalo, N.Y. 14221

To be completed 9 Dec 75

DOT-HS-5-01029 Mod. 4

TIRE TRACTION ON SURFACE MONITORING

Transportation Research Center of Ohio, East Liberty, Ohio
43319

No change

DOT-HS-5-01036 Mod. 1

DIAGNOSTIC MOTOR VEHICLE INSPECTION DEMONSTRATION PROJECTS PROGRAM EVALUATION SUPPORT

The contractor shall develop survey instruments; conduct pilot test in Washington, D.C.; and conduct five (5) day surveys in Huntsville, Chattanooga, San Juan, and Phoenix. The contractor shall also develop a remedial plan and schedule.

Computer Sciences Corporation, Systems Division, 6565
Arlington Boulevard, Falls Church, Va. 22046

No change

DOT-HS-5-01045 Mod. 1

DATA CONVERSION SERVICES FOR NATIONAL DRIVER REGISTER

Informatics, Inc. - IPS, 6425 Landover Road, Cheverly, Md.
20785

Extended to 30 Sep 76

DOT-HS-5-01063 Task Order 4 Mod. 1

ON-ROAD VEHICLE FAILURE STUDY

Opportunity Systems, Inc., 1330 Mass. Avenue, N. W.,
Washington, D.C. 20005

Extended to 1 Apr 76

March 31, 1976

DOT-HS-5-01169 Task Order 1

DOT-HS-5-01068 Mod. 3

UNIFORM TIRE QUALITY GRADING TREADWEAR COURSE MONITORING

The contractor shall conduct treadwear course monitoring tests. Each test involves one vehicle and one set of four (4) course monitoring tires. The treadwear test will consist of 16 400-mile circuits (8 runs) for a total of 6,400 miles. The purpose of the testing is to establish a course severity factor for radial tires and to evaluate new bias belted and bias course monitoring tires for uniformity within their own tire type and line.

Southwest Research Institute, 8500 Culebra Road, San Antonio, Tex. 78284

Extended to 31 Oct 75

DOT-HS-5-01099 Task Order 2 Mod. 1

CAR-TO-CAR AND CAR-TO-BARRIER IMPACT TESTING

The contractor shall perform the following vehicle static crush tests: 1975 Honda CVCC, Sedan, front and side crush; and a frontal crush test on a 1975 crashworthy subcompact, as selected in Task 1. The frontal crush tests will include longitudinal crush of a front door.

Calspan Corporation, Post Office Box 235, Buffalo, N.Y. 14221

No change

DOT-HS-5-01121 Mod. 1

TRAFFIC LAWS COMMENTARY: FLASHING LIGHTS ON EMERGENCY VEHICLES

This Commentary shall review all State laws as of January 1, 1975, relating to the use of flashing red, blue, or white lights on emergency vehicles, such as those motor vehicles delivering police, fire, or medical services. The Commentary will include a review of laws relating to flashing lights used by vehicles engaged in highway maintenance operations, wrecker services, rural letter carriers, farm tractor vehicles, and private cars of volunteer and paid firemen responding to an emergency call.

National Committee on Uniform Traffic Laws and Ordinances, 1776 Massachusetts Ave., N.W., Suite 430, Washington, D. C. 20036

No change

DOT-HS-5-01124 Mod. 2

RECONSTRUCTION OF ACCIDENT SPEEDS ON HIGHWAYS

The contractor shall modify the Calspan Reconstruction of Accident Speeds on Highways (CRASH) computer program to: improve its accuracy in predicting trajectories involving spins; modify calculations for absorbed energy to be obtained from six field measurements replacing the four measurements used presently; improve the interpretation of damage in oblique impacts; and adapt the program as a preprocessor for SMAC.

Calspan Corporation, P. O. Box 235, Buffalo, N.Y. 14221

Extended to 31 Jan 1976

DOT-HS-5-01156 Mod. 1

COMPUTER SUPPORT FOR DRIVER EYE MOVEMENT ANALYSIS

AMEX Systems, Inc., 1533 West 139th Street, Gardena, Calif. 90249

No change

DOT-HS-5-01160 Mod. 1

MOTORCYCLE ACCIDENT FACTORS

University of Southern California, University Park, Los Angeles, Calif. 90007

No change

DOT-HS-5-01166 Mod. 1

PARTS RETURN PROGRAM

The contractor is authorized to purchase 2,500 additional mail bags.

Kappa Systems, Inc., 1501 Wilson Boulevard, Arlington, Va. 22209

No change

DOT-HS-5-01169 Task Order 1

INSPECTION AND TESTING SERVICES OF MOTOR VEHICLE EQUIPMENT AND FABRICATION OR MODIFICATION OF VEHICLE EQUIPMENT AND CONTROL SYSTEMS

The contractor shall determine the temperatures at which significant thermal reactions, such as charring, smoking, burning, occur on various specimens of automotive interior material.

To be completed 21 days from date of task order award

DOT-HS-5-01169 Task Order 1 Amend. 1

INSPECTION AND TESTING SERVICES OF MOTOR VEHICLE EQUIPMENT AND FABRICATION OR MODIFICATION OF VEHICLE EQUIPMENT AND CONTROL SYSTEMS

The contractor shall perform thermal tests on three samples of undercoating and on two samples of interior material, and photograph the results.

Value Engineering Company, 2550 Huntington Avenue, Alexandria, Va. 22303

No change

DOT-HS-5-01169 Task Order 2

INSPECTION AND TESTING SERVICES OF MOTOR VEHICLE EQUIPMENT AND FABRICATION OR MODIFICATION OF VEHICLE EQUIPMENT AND CONTROL SYSTEMS

The contractor shall determine if various auto ramps will support loads as specified by their manufacturer, under four different test conditions: on level grade; one ramp misaligned; ramps tilted; and ramps inclined. Eight sets of ramps by six manufacturers will be tested by a vehicle 20 times.

Value Engineering Company, 2550 Huntington Avenue, Alexandria, Va. 22303

To be completed 30 days from date of task order award

DOT-HS-5-01169 Task Order 2. Mod. 1

AUTO RAMP TEST--ADDITIONAL WORK

Four (4) additional ramp makes are to be purchased and tested. The "half way up" test is deleted. The ramps are to be additionally photographed after first load application.

Value Engineering Company, 2550 Huntington Avenue, Alexandria, Va. 22303

No change

CITIZEN PARTICIPATION TO IMPROVE HIGHWAY SAFETY

The Regents of the University of Michigan, 260 Research Admin. Bldg., Ann Arbor, Mich. 48105

No change

DOT-HS-5-01186 Mod. 1

ALCOHOL SAFETY ACTION PROGRAM

State of Oregon, Motor Vehicle Division, 1905 Lana Avenue, N.E., Salem, Oreg. 97310

To be completed by 30 Jun 1975

DOT-HS-5-01218 Mod. 1

COMPLIANCE TECHNIQUES FOR PEDISTRIAN PROTECTION FEASIBILITY STUDY

Battelle Memorial Institute, Columbus Laboratories, 505 King Avenue, Columbus, Ohio 43201

No change

DOT-HS-5-01223 Mod. 1

INFLUENCE ON ROADWAY DISTURBANCES

Systems Technology, Inc. 13766 S. Hawthorne Boulevard, Hawthorne, Calif. 90250

No change

DOT-HS-5-01231 Mod. 1

MOTOR VEHICLE/BICYCLE COLLISION PARAMETERS

University of Southern California, University Park, Los Angeles, Calif. 90007

No change

March 31, 1976

DOT-HS-6-01280

DOT-HS-5-01243 Mod. 1

TRAFFIC SAFETY PROGRAM MANAGEMENT INTERNSHIP

University of Southern California, University Park, Los Angeles, Calif.

No change

DOT-HS-5-01250 Mod. 1

TECHNIQUES FOR PREDICTING HIGH RISK DRIVERS FOR ALCOHOL COUNTERMEASURES

University of North Carolina, Highway Safety Research Center, Craige Trailer Park - South Campus, Chapel Hill, N.C. 27514

No change

DOT-HS-5-01251 Mod. 1

UNIFORM TIRE TESTING

The number of tires to be tested shall be increased from 500 to 1000.

The Goodyear Tire and Rubber Company, 1144 East Market Street, Akron, Summit County, Ohio 44316

To be completed 21 days from date of modification

DOT-HS-5-01254 Mod. 1

ASPIRATION INFLATION TECHNIQUE

A 1975 Volvo Model 244 shall be used for Phase I Investigation instead of a lower priced car. The contractor shall use the NHTSA Computer System for analyzing the interaction between the air bag and the out-of-position child. In the Performance Evaluation Criteria, the femur load limit is changed to 2,200 pounds for the 50th and 95th-percentile male.

Calspan Corporation, 4455 Genesee Street, Buffalo, N.Y. 14221

No change

DOT-HS-5-01255 Mod. 1

STATISTICAL ANALYSIS OF LEVEL 2 RESTRAINT SYSTEMS DATA FILE

University of North Carolina, Office of Research Administration, South Building, Chapel Hill, N.C. 27514

DOT-HS-5-01257 Mod. 1

EFFECTS OF ALCOHOL AND MARIHUANA ON DRIVER CONTROL BEHAVIOR

Systems Technology, Inc., 13766 S. Hawthorne Blvd., Hawthorne, Calif. 90250

No change

DOT-HS-5-01259 Mod. 1

IDENTIFICATION OF UNSAFE DRIVING ACTIONS AND RELATED COUNTERMEASURES

The University of North Carolina, Highway Safety Research Center, Chapel Hill, N. C. 27514

No change

DOT-HS-5-01264 Mod. 2

MOTORCYCLE BRAKING PERFORMANCE

The Regents of the University of Michigan, 260 Research Administration Building, The University of Michigan, Ann Arbor, Mich. 48105

No change

DOT-HS-6-01279

STORAGE, PACKAGING, AND TRANSPORTATION OF COMPLIANCE TEST EQUIPMENT

The contractor shall store, pack, and transport tires and compliance test equipment as required during the contract period.

Victory Van Corporation, 950 South Pickett Street, Alexandria, Va. 22304, Attn: Mr. Lyles, Operation Manager

1 Aug 1975 to 30 Jun 1976

DOT-HS-6-01280

FORD PINTO STEERING GEAR TEST AND EVALUATION OJD CASE 04-28

The contractor will conduct four test maneuvers ("Z" and U-turns at 5 and 10 mph, and curve and trapezoidal at 20, 30, 40, and 50 mph) five times each. Steering gear components are to be examined before and after the tests. A 1972 Ford Pinto will be used as the test car, utilizing five rack and pinion steering gears for the five test runs. The contractor will deliver a final test report, strip charts, photographs, and video tapes of the tests.

To be completed 30 days from date of contract award

DOT-HS-6-01281

**PROCUREMENT OF BIAS BELTED TREADWEAR
COURSE MONITORING TIRES WITH SPECIAL
QUALITY CONTROL (UNIFORM TIRE QUALITY
GRADING)**

Contractor will provide 1,500 Armstrong Surveyor 78, G78-15, 4 ply tubeless tires. Production and quality control will concentrate on the production of tires with minimum variation in tread wear. Inspections will be made at the component mixing level, the fabric production level, the tire building and the tire curing levels. At each level, checks of specified characteristics will be made.

Armstrong Rubber Company, 500 Sargent Drive, New Haven, Conn. 06507

To be completed 30 days from date of contract award

DOT-HS-6-01285

**DECriminalIZATION: ADMINISTRATIVE
ADJUDICATION (NON-SERIOUS TRAFFIC
VIOLATIONS)**

The contractor shall propose how to measure the "fairness, efficiency, and effectiveness" of the decriminalization and administrative adjudication process and detect significant differences between it and the traditional court processing, as regards the disposition of non-serious traffic violations. The contractor shall develop a detailed research plan, in which comparison areas are selected; judges' criteria are defined; available data from the four geographic areas selected are determined; and criterion measures for "fairness, efficiency, and effectiveness", developed. Utilizing the research plan, judges and defendants will be interviewed; and court and driver records will be examined and evaluated to determine whether significant differences exist between and within areas; if there is an impact on highway safety; whether significant differences exist with respect to fairness, efficiency, and effectiveness between/within areas and between areas using administrative adjudication, and those using the traditional court processing; whether differences can be attributed to specific causative factors; and needs for further research.

PRC Systems Sciences Company, 7600 Old Springhouse Road, Mclean, Va. 22101

To be completed 30 Nov 77

The contractor shall quantify the effect on accidents, fatalities, injuries, and property damage in the overall traffic system, as a result of the implementation of FMVSS 121 (air brake performance). The role of each of the component parts of FMVSS 121 are to be evaluated in terms of its role in achieving the overall effect of the FMVSS. Additionally, the contractor shall identify any operational changes resulting from the standard implementation, such as changes in driver habits, tire life, component failure modes, and fleet maintenance procedures.

The Regents of the University of Michigan, 260 Research Administration Building, Ann Arbor, Mich. 48105

To be completed 27 months from date of contract award

DOT-HS-6-01287

**ELECTROMAGNETIC INTERFERENCE (EMI)
RADIATIVE MEASUREMENTS FOR AUTOMOTIVE
APPLICATIONS**

The contractor shall measure the electric field strength in the near field inside and outside of a passenger vehicle and of a tractor-trailer vehicle. Fields will be measure in and near vehicles adjacent to one with a mobile transmitter. An antiskid brake module will be subjected to various strength levels inside a TEM cell, and its susceptibility to the fields in the 10 MHz to 500 MHz frequency range will be measured. Data from these measurements shall be presented in a final report.

U. S. Department of Commerce, National Bureau of Standards, 325 Broadway, Boulder, Colo. 80302

To be completed 15 months from date of contract award

DOT-HS-6-01289

**LEASE OF STORAGE FACILITY AND HANDLING
SERVICES**

The contractor shall store, handle, destroy, and dispose of tires as shall be ordered from time to time during the period of performance of this contract.

Luther Transfer and Warehouse Co., Inc., 1841 Industrial Avenue, Post Office Box 3526, San Angelo, Tex. 76901

1 Oct 75 to 30 Jun 76

DOT-HS-6-01291

TRINC TAPE FOR TRUCK FLEETS

The contractor shall provide a computer tape, to include the following truck fleet data: name, address, Dun and Bradstreet data, number of employees, fleet size indicator, percentages of trucks and tractors powered by gasoline and diesel, and the number of vehicles by size.

March 31, 1976

Princ Transportation Consultants, P. O. Box 23549, Suite 4200,
475 L'Enfant Plaza, S.W., Washington, D.C. 20024

To be completed 31 Oct 75

DOT-HS-6-01295

EVALUATION OF SOLID STATE DIGITAL DATA RECORDER IN VEHICLE CRASH TESTS

The contractor shall test and evaluate a self-contained solid state digital data recorder mounted in a dummy in vehicle crash test applications. The intention of the program is to hand over the crash recorder equipped to the compliance facility and perform a total of five (5) crash configurations. Five (5) 1975 vehicles will be supplied: an Oldsmobile Delta 88, a Buick Electra, a Buick LaSable, and two (2) Volkswagen Rabbits. Two (2) 30 mph barrier crash tests will be conducted with the dummy in the passenger position, utilizing the Delta 88 (with a type 2 belt system) and the Electra (with air bag only). Three crash tests will be conducted with the dummy in the driver position: a 30 mph frontal barrier crash, using the LaSable (with lap belt only); a 20 mph moving barrier, driver side impact, using a Rabbit with a standard restraint system; and a 20 mph moving barrier, passenger side impact, using the other Rabbit, also with a standard restraint system. In addition to strip chart recordings, motion and still pictures records are to be made of each crash.

Ultrasystems, Inc., The Dynamic Sciences Division, 1850
West Pinnacle Peak Road, Phoenix, Ariz. 85027

To be completed 90 days from date of contract award

DOT-HS-6-01296

CALIBRATION PROCEDURES OF TEST DUMMIES FOR SIDE IMPACT TESTING

The contractor shall provide the required manpower, facilities, and equipment for the purpose of developing and establishing testing procedures and performance and calibration criteria of test dummies and dummy components related to side impacts as follows: review available biomechanical data pertaining to actual and simulated side impacts, including those with live subjects, cadavers, and dummies; determine, using sled tests, which dummy component parts and parameters have a significant control over the overall dummy response to side impact; and develop, establish, and recommend appropriate tests, testing procedures, and calibration criteria by which test dummies shall be characterized and qualified for side impact compliance testing.

The Regents of the University of Michigan, 260 Research
Administration Building, The University of Michigan, Ann
Arbor, Mich. 48105

DOT-HS-6-01301

DOT-HS-6-01298

CRASH AVOIDANCE AND CRASH TESTING OF ESV'S

The objective of the project is to provide, through comprehensive testing, and safety performance data on selected, advanced state-of-the-art safety vehicles. Three (3) British Leyland Phase 1 Marina ESV's will be involved in two tests: a Marina ESV to an AMF ESV, front-to-front centerline crash; and a Marina ESV to Marina ESV front-to-side crash. During each test, the Marinas will contain four (4) 50th percentile male anthropomorphic test dummies (two (2) Hybrid 2 and two (2) Sierra Model 292-1050). An optional series of tests may be added, which will evaluate the Opel ESV.

Calspan Corp., Post Office Box 235, Buffalo, N.Y. 14221

To be completed 15 Dec 76

DOT-HS-6-01299

EFFECTIVENESS OF PUERTO RICO'S MANDATORY SAFETY BELT USAGE LAW

The passage by the Government of Puerto Rico of a bill requiring the use of safety belts, which became effective on 1 Jan 1974 must be accompanied by certain survey activities necessary to assist in assessing its effectiveness. The work described in this document is designed to fulfill this requirement, through the use of monthly surveys. During each month, approximately 10,000 automobiles will be observed to determine whether or not the driver and passengers are wearing safety belts. Both urban and rural samples will be collected to obtain a representative cross section. Only vehicles covered under the mandatory usage law will be included.

Puerto Rico Traffic Safety Commission, 1508 Ponce de Leon
Avenue, P.O. Box FI, Santurce, P.R. 00910

To be completed six (6) months from date of contract award

DOT-HS-6-01301

VEHICLE EYE REFERENCING DATA

The objective of this project is to obtain in-vehicle eye referencing data from a subcompact or compact size car which would be useful to upgrade compliance testing procedures for field of view standards (such as fields of direct view, rearview mirror systems, and defrost and defog systems). This project supplements an existing contract (MVMA agreement WSU-7504-C4.17) by adding one vehicle of the compact or subcompact type from either 1974, 75, or 76, to be tested with twenty-five (25) subjects, in accordance with MVMA testing procedure.

Wayne State University, 5050 Cass Avenue, Detroit, Mich.